CHEMISTRY

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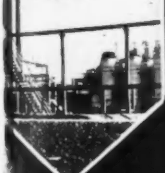

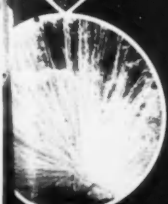

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Out of This World

➤ BEFORE we can understand the world in which we live we must have some understanding of the behavior of the materials of which it is made. Before we can understand our fellow men we must have some understanding of the chemical reactions which make them behave the way they do. Students who blind themselves to the world around them for fear science courses may be "dull" or "too hard" are shutting themselves away from experience in the realities of life.

Man is but one of a myriad of creatures whose lives are unstable chemical reactions. They are kept going by chemical energy, at atmospheric pressure, within the very narrow limits at which water exists in the liquid phase. These creatures compete with each other for the water, the air and the carbon dioxide available. Taking part of the energy radiated to our small planet by the atomic reactions in the sun, those living forms which contain chlorophyl can put these substances together. On them all life on earth depends.

One great challenge to our most skillful chemists is to try to become as smart as a green leaf. Other substances, produced by living matter but not, themselves, qualifying as more than unusually energetic chemicals, can initiate organic syntheses essential to life as we know it. Another challenge to chemists is to become as smart as these enzymes.

Some processes we have learned to control within the limits with which we are familiar. We are beginning to move outside our traditional environment, and study reactions of materials in conditions where we cannot live except by special contriving. The challenge of this larger, more difficult world is before the student of today.

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Editors: WATSON DAVIS and HELEN MILES DAVIS

Consulting Editor: PAULINE BEERY MACK (Editor 1927-1944)

➤ LIQUID *and gaseous metals and their oxidation products are the materials of research in high temperature investigations. Mr. Russel A. Miller, project supervisor of the high temperature research laboratory at Temple University, Philadelphia, pours melted metal while Mr. Abraham Kirshenbaum operates a small furnace made of the oxide of the same metal that is burned inside it.*

Artificial Suns

by HELEN M. DAVIS

➤ BEYOND the narrow temperature range in which water is a liquid, lie great stretches of almost unknown territory. In many laboratories men are pushing back the frontiers of this little-known world and finding that under new conditions familiar substances take on strange properties.

One of the laboratories where such researches are carried on is at the Research Institute of Temple University in Philadelphia. Russel A. Miller, project director of high temperature research there, runs furnaces in which the fuel is aluminum or magnesium in the form of six-foot lengths of slender metal rods. Oxygen under pressure is fed into the furnaces through water-cooled nozzles.

The metal melts. Pools of it, bright as the sun, can be watched through suitable goggles as the metal's vapor burns above its surface. Clouds of white oxide billow out. The pools of liquid metal can be broken up or pulled together like droplets of mercury by the experimenter. He uses for the

➤ CALCIUM VAPORS *burn at the mouth of a small melting pot to produce, for man's investigation at the Temple University laboratory, temperatures close to those existing at the surface of the sun.*

purpose one of the fuel rods during the fleeting time before it melts.

Each metal has its own characteristics as a liquid. The "sun" which it forms differs in temperature, color and other physical properties from "suns" formed by other metals.

The chemical action of one element, also, is different from that of another. This fact has to be kept in mind in choosing fire-resistant materials to contain burning metals.

The one material with which the chemist can be sure a liquid metal will not react while burning is that element's own oxide. The properties of the metallic oxides are therefore of great interest to the high temperature research man.

The old-fashioned way of designating the oxide by changing the ending of the metal's name from "-um" to "-a" is useful here. Alumina, which is formed when aluminum burns, is used to make the refractory pot for burning aluminum. Magnesia, the oxidation product of magnesium, makes the pot in which magnesium burns.

Should aluminum be burned by mistake in a pot made of magnesia, reaction between the two metals goes on at the same time as the oxidation of the aluminum rod, and may result in failure of the walls of the containing vessel.

White-hot molten metal is not a comfortable material to have around loose, as people know who have experienced the kind of incendiary called "thermit". That is aluminum powder, with the appropriate tinder to start it burning. Aluminum is not easily ignited, but develops enormous heat once it starts.

Magnesium, on the contrary, is ignited easily. It was the ingredient of early type flash-light powder. It gives off a brilliant actinic light, followed by dense clouds of magnesia. This material used to float in the air after a flash-light photograph, choking the subjects, absorbing light and generally ruining the chance for a second picture.

Magnesium as a structural metal, on account of its strength and light weight, is a favorite with designers looking for improved airplane materials. The fearsome flammability of the pure metal is a real hazard in a field where fire risk is always present. Fortunately, when combined with aluminum, magnesium forms lightweight alloys which inherit aluminum's high-ignition-point character.

Magnesia, the oxide, is closely related in its chemical properties to lime, the familiar calcium oxide. The lime-light of the theater was an early utilization of the refractory nature of metallic oxides. Calcium is also used as a fuel in the Temple University Research Institute experimental furnaces. It can be burned in pots made of alumina.

Thoria, oxide of the heavy, radioactive metal thorium, is generally believed to be the most efficient refractory, but its potential use to make fissionable material takes it off the list of fire-brick possibilities.

As "earths", lime and some of the other metallic oxides are among the oldest materials known to man. Bricks, pottery, china and glass de-

veloped from early man's experiments with this type of material. Today, after predominance of metals, for a time, as stuff to be fabricated, chemists are again turning to the inert ceramic materials. They are even incorporating some of them into organic-type molecules. These researchers are looking toward heat-resistant products for such uses as jet nozzles for rockets.

They also contemplate turbine blades for engines of the future, in which present-day steam will be replaced by liquid and vaporized metals. Before the economies expected from such novel power sources can be realized, much more must be known about how matter may be expected to behave at very high temperatures. When these conditions are mastered, the way to practical use of atomic power will be better understood.

Temperatures inside the present-day atomic piles are low, but engineers believe that, if structural materials can be found which will withstand high temperatures, development of atomic power lies in that direction.

On the Back Cover

➤ BURNED OUT *by the artificial sun created when calcium flamed inside it, this refractory furnace was photographed, in the Temple University high temperature research laboratory, by its own infra-red radiation.*

Emergency Gas from Liquid

➤ EMERGENCY gas for heating and domestic fuel can be produced from liquids easily stored ready for instant use.

Designed to meet peak demands upon natural gas systems during the few days of severe winter weather, the emergency gas can be manufactured from air and some volatile petroleum hydrocarbon, such as propane. A double overload could be met in this way.

Dr. R. M. Deanesly of the Universal Oil Products Co., Chicago, reported to a recent meeting of the American Chemical Society that this autothermic process has been developed on a pilot plant scale and is ready for full scale application.

The air and propane are heated separately to over 1000 degrees Fahrenheit, mixed, and allowed to react for a few hundredths of a second in a brick-lined stove. Some of the propane is burned and the rest is converted into smaller molecules. This gives gas that will mix with natural gas when fed into the system to tide over the emergency.

In the Air But Not for H-bombs

Tritium Found in Air

▶ MATERIAL for making hydrogen bombs will not be extracted from the air even though one of the H-bomb ingredients, tritium (triple-weight hydrogen) has been discovered in very small amounts in the moisture of the air.

It is found as one part of tritium in a million times a million times a million (1,000,000,000,000,000,000) parts of the water's hydrogen.

The real importance of the identification of this natural tritium made by cosmic rays is the fact that it is the world's rarest natural chemical element.

Recognition of naturally occurring tritium, announced by Dr. Aristid V. Grosse of Temple University's new Research Institute, as a result of his studies with Dr. W. F. Libby of the University of Chicago, climaxes a 15-year-old scientific dispute as to whether the short lived isotope exists only when man-made. The team of atomic scientists find that it is constantly being made in nature by action of cosmic rays on the nitrogen of the air.

Discovered as the result of atomic bombardment by the British scientist, Lord Rutherford, tritium was believed to exist only as a man-made particle until 1935, when Dr. Hugh S. Taylor, of Princeton University, discovered indications of tritium in water concentrated electrolytically in his laboratory. Dr. Taylor and his associates were at the time studying the then newly discovered deuterium, the heavy hydrogen which is not radioactive. They based their claim to finding tritium on determination of the weight of the hydrogen in water from various parts of the United States. In this study they had found that water in the clouds crossing the Rocky Mountains is separated according to the weight of the isotopes of hydrogen which compose it.

Taking a sample of water containing tritium with him, Dr. Taylor in 1935 went to London to visit Lord Rutherford, and was roundly denounced by the scientific leader for claiming an impossibility. Rutherford then gave Dr. Taylor one cubic centimeter of concentrated water and challenged him to find tritium in it. Today's techniques, with much greater accuracy in measuring radioactive strength, have proved that the sample to which Rutherford pinned his faith was giving off radio-active disintegration products of tritium all the while.

Besides the sample from Rutherford's laboratory, sent to Dr. Grosse and Dr. Libby for analysis by Dr. Taylor, other samples of water concentrated by electrolytic action have been analyzed by the research team. One sample was furnished by the Norsk hydroelectric plant, for which Norway has received scientific thanks. This sample came from the surface

waters of the ocean. Its tritium content is to be compared with other samples from equatorial regions and from the depths of the sea. Cosmic rays, which are believed to be the source of tritium in nature, are more plentiful in the northern regions of the earth, and have more effect near the surface than at great depths in the ocean. Turbulence of the ocean waves mixes the surface waters, but is believed not to disturb layers of water below about 300 feet.

There should be more tritium at the north pole than at the equator because there is more cosmic ray bombardment in the northern latitudes due to the focusing of the cosmic radiation by the magnetic field of the earth.

There should be more tritium, just as there is more deuterium (double-weight hydrogen), in the water of rain on one side of the Rocky Mountains than the other side to which the storm travels.

There is little practical use of naturally occurring tritium just now. The extremely accurate methods of detection of its radio-activity would hardly be useful for childish snooping to see who is making tritium for bombs behind our backs.

Three years ago Drs. Grosse and Libby discovered that cosmic rays produce radioactive carbon 14 in living matter. This has provided a reliable radioactive method for determining the age of archaeological samples.

Translations of Soviet Science

▶ If you want to know what Soviet scientists are writing about and you can't read Russian, you can get the information from the Atomic Energy Commission's Brookhaven National Laboratory, at Upton, N. Y., on Long Island.

This government-supported scientific agency is the largest distributor of Soviet scientific information in the nation.

About September, 1947, as part of the conflict between the East and West, all Russian scientific journals stopped publishing titles and abstracts in languages other than Russian. Many of the 30 journals issued by the USSR Academy of Sciences used to have English titles and abstracts.

Even the all-Russian issues are readily available outside the Soviet Union within several months of their publication, the Brookhaven authorities found. So they now issue translations of the titles of all articles in Russian scientific journals, ranging from astronomy to zoology. All physics articles, including nuclear science, are given in English abstracts. Complete translations are made of articles they consider significant, either to the atomic energy program or to science in general.

Issues of "Guide to Russian Scientific Periodical Literature," are prepared under the direction of Prof. John Turkevich, of Princeton's chemistry department, and Dr. Ludmila Turkevich of Princeton's modern language department.

Scientific Facts, Not Politics, Dictate Atomic Control Conditions

The Problem of the Atom

Reprinted from Our Foreign Policy, Publication No. 3972, U. S. Department of State.

THE CHARTER of the United Nations was signed on June 26, 1945. Hardly 6 weeks later something happened that created an urgent need for new patterns of international cooperation—a need that the signers of the Charter did not and could not have taken into account.

The atomic bomb exploded on Hiroshima. The full meaning of that event was not understood at the time and is still not universally realized.

The bomb was not the first weapon of mass destruction—or the last. It did not change the basic facts of life in a pioneer international society. It did not make war either more or less probable, but it made the effects of war more terrible. Therefore, those who thought deeply and calmly about the meaning of the bomb came to two simple conclusions; prevent war and find an effective way to outlaw the bomb and develop atomic energy for peaceful purposes only.

Ever since 1945, American policy has proceeded from these two conclusions. To prevent war was already our major interest and concern. The use of atomic energy presented us with a new and baffling problem. Let us consider the nature of the problem.

The technical details of atomic energy and of the weapons we have developed from its devastating power are very complex indeed, but the principle of the atomic bomb is very simple. All you have to do to blow a city off the map is to get together enough plutonium or a rare form of uranium in one lump. There is nothing more to it than that—a lump of metal of a certain size. Anyone can do it if he has a way of getting the stuff, knows how to protect himself against the poisonous radiations, and can delay the explosion until he is ready for it. The principle of the hydrogen bomb is also simple enough; whether it can in fact be developed is not yet known. All you will need is a very high degree of heat, a degree so high that probably only a uranium or plutonium bomb could supply it. The horror of this situation is that literally anyone with access to the refined materials could bring about an atomic explosion. What other course is there but to keep this dangerous stuff away from irresponsible men and nations?

Within a year after the bomb exploded on Hiroshima, the United States had devised plans and proposals for doing just that: keeping the dangerous stuff out of irresponsible hands. We decided to put domestic control and development of atomic energy under the authority of a civilian commission. This decision became law on August 1, 1946, when the President signed the McMahon Bill.

We decided to put the problem of international control of atomic energy squarely up to the United Na-

tions. Canada, China, France, Great Britain, and the Soviet Union agreed to this plan, and in January 1946 the first General Assembly of the United Nations created a Commission on Atomic Energy with instructions to work out a plan of effective international control.

By June 1946 the United States was ready with preliminary proposals for such a plan, and Bernard Baruch, the American representative, put them before the Atomic Energy Commission of the United Nations. The proposals were based on the report of a group appointed by the President, early in January, to study the problem of atomic control from the point of view of national security and international peace. The report of this group, known as the Acheson-Lilienthal Committee, came to the following conclusions:

that effective workable international control *was possible*.

that international inspection of national atomic activties was not, by itself, good enough to safeguard the security of individual nations;

that, therefore, a new kind of international authority had to be created which would itself own all the raw materials and carry on all the "dangerous" operations in the field of atomic development. The nondangerous aspects of development could be in national hands, but these national activities would have to be licensed and inspected by the international authority.

The United States offered to give up its monopoly of atomic weapons and turn over its technical knowledge for an effective international system of this kind. When such an adequate system of control had been approved and had come into effect step by step, then, we proposed, the manufacture of atomic bombs would stop; existing bombs would be disposed of by agreement; and a world-wide Atomic Authority would be in possession of all information about the production of atomic energy for both peaceful and military purposes.

These are the main provisions of the United Nations plan which was approved by an overwhelming vote of the General Assembly in 1948. It is an honest plan, aimed at genuine control and promising a high degree of security to all nations. No other method has yet been found that offers genuine control or security.

This plan has been rejected and fought by the Soviet Union and its satellites. The Soviet Union stands on its own proposals to outlaw the bomb by "agreement" and to keep atomic development in the hands of each nation, with a vague promise of international inspection. The intention behind these Soviet proposals is clear; to create a false sense of security which would serve the purposes of an aggressor.

Is it possible to find a satisfactory compromise somewhere between the United Nations plan and the Soviet proposals? If such a compromise existed in the realm of honest, effective control, no peace-loving people could refuse to accept it. But in this case, the conditions for effective control are dictated not by national policy but by the scientific facts of atomic energy. There is no getting around the facts that say that anyone who has

the raw materials and the machinery for making atomic energy for peaceful uses can also make bombs with little effort and no amount of inspection from the outside can stop him.

So the real problem is not to find a compromise plan. It is to persuade the Soviet Government that the highest interests of its people will be served by cooperating in the effective control and sharing in the peaceful benefits of atomic energy.

The Soviet Union has deliberately set out to confuse the issue. Through propaganda and phony "peace" offensives it has tried to gloss over its rejection of effective international control and to convince the great majority of peace-loving people that the use of atomic weapons in any circumstances is a crime.

Certainly, the American people are reluctant to use atomic or any other kind of weapons. But they are not fooled by the Soviet propaganda trick. They know that the real crime is *aggression*; the real criminal is the nation that makes war or foments war by threatening others or by spreading hate and fear.

Because Soviet propaganda constantly plays on the hopes and fears of so many peaceful people, the American position needs to be clearly and repeatedly explained.

We believe that honest and effective international control of atomic energy holds out the only hope for peace and security, not only for ourselves but for all other people. We shall go on working for that solution.

Until peace is secure, we believe that the free world must arm itself well for defense. Atomic weapons are one element in that defense, and we shall continue to develop them. But we should not make the mistake of overestimating the value of the bomb. Gen. Omar Bradley gave us an accurate estimate when he said: "Our stockpile of atomic bombs, and our ability to deliver them, affords us an immediate but inconclusive blow of retaliation."

To deny to the free world the possibility of striking even this "inconclusive" blow of retaliation would be reckless in the extreme, for it would play into the hands of an aggressor.

Low-Cost Power From Low-Grade Fuels

➤ HIGH COSTS of burning inferior fuels in German power plants are being offset by economies in plant construction the American Society of Mechanical Engineers was told by Dr. Ludwig F. Musil, Graz, Austria.

Despite the deterioration in the quality of fuel available, station heat rates in German power plants have continued to improve since World War II. Much of the fuel used is lignite, also known as brown coal, and coal wastes from separation plants where the better grades are removed for use where high-grade fuel is necessary.

Pasteurization of milk in the United States has been practiced for 40 years.

Ion-Exchange Method in Radioactive Waste Riddance

Radioactive Wastes Disposal

➤ METHODS basically similar to those used in home water-softening plants may be one solution to the problem of getting rid of radioactive wastes from a laboratory engaged in atomic research.

Dr. John A. Ayres told of his experiments with the so-called ion-exchange technique at the Knolls Atomic Power Laboratory, which is operated at Schenectady, N.Y., for the Atomic Energy Commission by the General Electric Company.

He said these experiments show that even though laboratory wastes are a conglomerate mixture varying from day to day and containing solids, oils, organic solvents and other chemicals, the radioactive elements can be removed even when present in small amounts in very dilute solutions.

Dr. Ayres made use of "synthetic" wastes, deliberately contaminated with radioactive substances obtained from the Oak Ridge National Laboratory in Tennessee. The experiments were performed on a laboratory scale, but it is believed that they would be applicable to larger plants.

In commercial use, as in water softening, it is the practice to regenerate the ion exchange resins, putting back the original ions so that they may be used over again. This, however, was not done in Dr. Ayres' experiments, since the purpose was to compact the wastes into a small volume of solid materials. After the radioactive ions had been removed, yielding a liquid that could be safely discharged into the sewers, the radioactive atoms were left in the solid resins. These were burned, concentrating the radioactivity to the ash, and making a reduction of about 15 times in volume.

Where a high degree of decontamination is needed the liquid waste might flow through two columns containing the resins—one to remove the positive, the other the negative ions—and then to the sewage disposal system. After their exhaustion the resins would be removed and burned.

Dr. Ayres estimated that for a laboratory producing each week 1,000 gallons of liquid waste with a solid content of two-tenths of one per cent, the cost of the resins would be about $50 a week. The final volume of the solids would be six-tenths of a cubic foot, or a concentration factor of about 1,200. Over 99.999 per cent of the radioactivity would be removed from the original wastes to give a discharged liquid comparable to distilled water. For most laboratory wastes this would be sufficient and the final product would have no detectable radioactivity. Where the wastes are less highly contaminated, a simpler and less expensive system might serve the purpose.

Six Mills Operating to Give Atomic Energy Material

Uranium Production Important

SIX URANIUM mills producing the number one essential for atomic energy are now in operation in the United States.

Uranium milling is a new industry, introduced in 1942, but it is destined to play an important role in the field of mining and milling.

The American Mining Congress was given a review of uranium production by F. W. McQuiston, Jr., of the U.S. Atomic Energy Commission. Uranium is widely distributed in the rocks of the earth's crust, he said, but it occurs sparingly as high-grade ore deposits. It is more plentiful than gold and silver, and almost as plentiful as lead and zinc.

The six mills now operating are in Colorado and Utah. One other is under construction and two more are planned for the near future. First important operations were the leaching of accumulated piles of tailings from milling vanadium ores in Colorado. In the near future several million tons per year of low-grade materials will be milled for the recovery of uranium.

Canadian and other foreign operations are producing uranium. The largest milling operations on which information is available are those at the Shinkelowbe mine, Belgian Congo; Eldorado mines, Great Bear Lake, Canada; and on the Colorado plateau in Colorado and Utah. Gold production in South Africa, oil shale in Sweden and marine phosphate deposits in the United States offer potential by-product uranium production.

Of the great variety of uranium occurences, pitchblende ores have been by far the most productive. Uraninite, another primary mineral, has considerable economic importance. Certain secondary minerals have also contributed to uranium production.

Uranium mining for the essential atomic energy mineral is private business in the United States. Under the policy of the U.S. Atomic Energy Commission the job of finding, mining and processing uranium ores is left to the mining industry.

The government is the only buyer. It fixes the ore-buying price. Prices are fixed to encourage prospecting and mining. The Commission is helping the industry by making geological surveys, by furnishing free testing and assaying service and, more important, by guaranteeing a market for the uranium ores.

The domestic uranium policy of the Atomic Energy Commission was explained by Jesse C. Johnson of the Commission. When the policy was first announced two years ago, there were only 15 individual uranium mining operations employing a total of 55 men, he said. Today there are over 200 different mining operations with total employment in excess of 1,000, and production is at an all-time high.

This increase in production has been

achieved without government financing of private operations. All the ore is produced from privately-owned mines and over 80% is processed in privately-owned plants.

Uranium mining can be a profitable business, and the prices paid are sufficiently attractive to induce mining companies to develop and operate mines and construct uranium milling plants.

Most mining activities are in the Colorado Plateau area, but nearly 100 government geologists are studying uranium occurences in other parts of the United States. The work of these geologists is not enough, however. The success of any nation-wide search for minerals depends upon enlisting the hundreds of prospectors, miners and geologists who are out looking for all types of mineral deposits.

All mining companies should have their geologists and mining engineers on the lookout for uranium. Geiger counters should be standard equipment for every exploration department. Underground workings and drill cores should be checked for radioactivity. A recent Idaho discovery of pitchblende, an important uranium mineral, was a result of a radiometric survey.

Uranium is One Big Complicated Family

➤ THE ATOMIC bomb element uranium is a family with probably seven members. And like a large human family, it can get pretty complicated.

The uraniums are known by their weights—the atomic weights of chemistry which are based on giving the oxygen atom a weight of 16.

Uranium 235 is the atomic bomb variety or isotope. It is found in natural uranium in small amounts—about 11 pounds in a ton of the concentrated metal. Uranium is about the heaviest stuff known. Seven grams would be about the size of a big pea, if it's all in one chunk. (Uranium is nearly 19 times heavier than water; lead is only 11 times heavier.)

Uranium 238 is the common metal which makes up most of the natural uranium found on the earth. Like all forms of the element it is radio-active, but it is not fissionable—will not release atomic energy.

Other members of the family are: U-233, possible bomb stuff made from another element, thorium; U-234, made in the laboratory and not reported capable of releasing atomic energy; U-237 and U-239, also man-made and not believed to be fissionable. Seventh member of the family may be U-236. This isotope has not been reported, but chemists suspect it can exist, probably for a very short time.

Penicillin is being produced on a commercial scale by 21 plants in the United States and Canada, as well as by many others in foreign countries.

Discoveries About New Elements

More Light on Man-Made Elements

➤ A HEAVY metal that is much lighter than expected has come to light with the metallic isolation of the universe's 95th element, americium, announced to the American Chemical Society by Dr. Edgar F. Westrum of the University of Michigan.

Plutonium, the modern A-bomb element, is number 94 and heaviest substance among the 98 elements known. Americium, just obtained in its silvery metallic form, has only about half its parent's density.

This means that even though americium's atomic weight is greater than that of plutonium, two bricks of americium would be necessary to counterbalance one of equal size made of plutonium. This is because inner forces give the americium atom a more expanded structure.

At least five new chemical elements beyond californium, number 98, will be discovered in the future, Dr. Glenn T. Seaborg, University of California professor and plutonium's discoverer, predicted in an interview.

He is able to predict the chemical properties of the rest of what is called the actinide series, which ends with the element 103 whose atomic weight will be 267. Elements beyond 95 may be lighter than plutonium and uranium, if the tendency toward lower density shown by americium continues.

Only 5,000 atoms of the most recently discovered element, californium, exist, Dr. Seaborg said, and future new elements manufactured out of transuranium elements will be even rarer.

It is not known whether this process of synthetic building of elements duplicates ancient elements, long extinct, that once existed on earth or whether man has now gone nature one better and made material that has hitherto been impossible.

Curious Curium

➤ A METAL which glows as brightly as a flashlight in the dark has been produced as an aftermath of the atom bomb project.

The metal—which unfortunately could not be used in place of an ordinary flashlight because of its deadly radioactivity—is the pure form of curium, one of the elements discovered in 1944 as a result of atomic energy research, reported Dr. J. C. Wallman, Dr. W. W. Crane, and Dr. B. B. Cunningham of the University of California.

Curium's remarkable brilliance is helpful in finding small pieces of the material in the working area, since otherwise the metal is invisible.

The material's power output is such that samples of the metal are at a substantially higher temperature than their surroundings. This means that to perform experiments at ordinary room temperature, the pieces of metal must be artificially cooled.

Curium, which is element 96 in the periodic table, is made by bombarding americium, element 95, with neu-

trons in an atomic pile. The process is carried out at 2,400 degrees Fahrenheit in a capped, cylindrical crucible a half-inch in height and three-sixteenths of an inch in diameter, containing a small inner crucible only one-sixteenth inch in height by one-sixteenth inch in diameter in which the ball of metal forms.

The extremely small scale of operation is the principal difference between the curium production method and that used for other more readily available elements.

The entire process is scaled down, it was pointed out. Loading of curium trifluoride, the starting material for the production of metallic curium, into its inner crucible is done under the magnification of a miscroscope, since the amount of curium trifluoride used is so small that, to the unaided eye, the material appears about the same size as dust particles. The metal globule produced is so tiny that it is invisible to the naked eye.

The extreme radioactivity of curium also presents experimental difficulties, since it corrodes porcelain or glass crucibles and within a few days a piece of curium metal will tend to disintegrate the containing vessel. Quartz tubes constructed for X-ray measurements will fall apart from the radiation after containing the curium only 124 hours.

Because the presence in the human body of small quantities of curium would be fatal, all work is performed with the material enclosed in glass-front boxes. At the University of California Radiation Laboratory, where much of this type of hazardous experimental work is carried on, a group of engineers, known as health chemists, has been organized just to design and build protective equipment for any potentially dangerous experiment. Many of the investigations involving radioactive elements are possible only because of the expert advice of groups such as this one.

Production of curium metal is of chemical interest because of the relationship between curium and the adjacent elements in the periodic table: uranium, neptunium, plutonium, and americium. These elements show a certain similarity of properties, and experimentation with curium metal enables its properties to be related to those of the other metals.

The paper was presented at a recent session of the American Chemical Society's Division of Physical and Inorganic Chemistry. A report on the chemistry of the new element 97, berkelium, which was discovered in December 1949, by Dr. S. G. Thompson, Dr. A. Ghiorso, and Dr. Glenn T. Seaborg at the Radiation Laboratory, was given in another paper by Dr. Cunningham and Dr. Merle E. Jones.

Only one-billionth of a billionth of a billionth of an ounce of berkelium has been produced, according to the report, which points out that this is a quantity of matter completely undetectable by any chemical test. The element was made by bombarding americium with charged helium atoms in the university's 60-inch cyclotron. So far, study of the element has been possible only by observation of its radioactive behavior. On the whole, it was found, berkelium resembles the other new elements in the transuranium group.

Metals, How to Find, New Deposits and Properties

Locating Underground Minerals

➤ A COMBINATION geological-chemical method of locating hidden minerals in the earth, known as geochemical, is proving successful.

The idea is not new. The new feature is the application of chemical tests to mapping patterns relating to ore deposits, The American Mining Congress was told by H. E. Hawkes of the U.S. Geological Survey.

The geochemical method consists of analyzing soils and vegetation for trace quantities of metals. Extreme analytical accuracy seldom is necessary. But speed of analysis of samples is exceedingly important. The time lag between collection of samples and the receipt of the analytical report should not exceed one week.

Spectrographic and colorimetric methods are both employed in the analysis work. The former has limitations due to the cost and the bulk of the equipment. Colorimetric methods are used almost exclusively in North America.

Geological Survey chemists have developed rapid tests for zinc, copper, nickel, cobalt, molybdenum, and the undifferentiated group made up of lead, copper, zinc, nickel, cobalt and some rare metals. Under research are methods for determining arsenic, antimony, tin, mercury, barium, titanium and others.

The result of geochemical work done by the Tennessee Copper Company, Ducktown, Tenn., was moderately encouraging. Owen Kingman, company geologist reported that the results of the work indicate that a rapid technique will yield constant results that may be utilized to detect mineralized channels and thus contribute another factor to help the geologist find ore.

Germanium Found in Capital

➤ THE RICHEST deposit of the vital war material, germanium, yet found in the United States has been discovered in the earth of parks, playgrounds and other locations in the nation's capital.

This vein of treasure from the Patuxent formation runs from Baltimore to Richmond, U.S. Geological Survey scientists find.

The deposits contain up to 6% germanium. The highest content previously reported, in the mineral germanite in Africa, was 10%. The District of Columbia deposits also contain vanadium, chromium and gallium.

Discovery of the new germanium deposits was made by Miss Taisia Stadnichenko, K. J. Murata and J. M. Axelrod.

The deposits are in the lignite remains of *Cupressinoxylon wardi*, a tree somewhat similar to the coniferous family, from the Cretaceous era, about 100,000,000 years ago.

Germanium is particularly valuable for electronic instruments. It is a semiconductor, standing half-way between

materials that are conductors and those that are insulators. Photo-electric cells, rectifiers, transmitters and mixers (combination transmitters and amplifiers) are among the important uses for germanium crystals. The crystals are rapidly replacing vacuum tubes for many uses.

Previous to this discovery, the main source of germanium has been a by-product of a by-product of a by-product. That is, when metallic zinc is concentrated, the fumes containing cadmium are collected. From these fumes, germanium, present in small amounts, is concentrated.

Gallium, Strange Metal

➤A NEW "mystery metal" is gallium. The mystery is what to do with it.

Gallium is liquid at room temperature like mercury, which it also resembles in appearance. It is so active that it combines with any metal or glass with which it comes into contact and thus will dissolve any container except rubber or ceramic material. But it will not mix with mercury.

It will melt in your hand above 86 degrees Fahrenheit, but it will boil only over 3600 degrees Fahrenheit. It is one of the few substances which, like water, expands on freezing.

It can be painted on glass to make a good mirror, but you can see through the mirror both ways. And if the mirror gets too warm, the gallium may run off.

During the war the Germans made quartz thermometers with gallium in the tube, which were good up to about 2200 degrees, but no one has yet been able to learn how they were used, since a thermocouple is better. Gallium is a good heat conductor, but it must be handled in ceramic or rubber containers. It is highly resistant to acids and caustics. Though a liquid, it combines into extremely strong alloys. It is used in dental alloys instead of toxic mercury.

Minor Metals in Industry

➤BALANCE wheels for watches are made of beryllium-nickel alloy, glass-cutters are made of boron carbide, cigarette flints are made of cerium, and television equipment functions with the aid of cesium and rubidium, the U.S. Bureau of Mines states in its latest Minerals Yearbook.

These are just a few of the so-called minor metals, many of which are now beginning to play major roles in electronics and metallurgy. Few ever see them in their pure forms because they are used in minute quantities in alloys with iron, copper and other common metals to impart strength, resistance to heat and corrosion and other properties important for a special use.

Listed are metals which many never hear about. They extend from barium to zirconium. Included are beryllium, boron, calcium, cerium and other rare-earth metals, cesium, rubidium, columbium, tantalum, gallium, germanium, hafnium, indium, lithium, rhenium, scandium, selenium, tellurium, strontium and thallium.

High-grade camera lenses are made partly of tantalum oxide and the metal is used in human surgery. Radio and television rectifiers are made of selenium. Rodent poisons contain thallium sulfate, and flashlight powders are made of zirconium.

Melting and Solidification

➤THE melting point and the solidification point of a metal are not identical

temperatures in spite of the fact that they are generally believed to be the same.

Scientists of the General Electric Co. have been studying the behavior of metal droplets by means of special microscope equipment. They find that a molten pure metal solidifies at temperatures lower than the temperature at which the metal melts.

Impurities in a metal cause solidification at a higher temperature than the solidification point of the metal in pure form, they say. The barest trace of impurities is enough to make molten metals "freeze" at temperatures above the solidification points for pure metals.

By means of a special attachment to a microscope, the scientists observed, through a quartz window, droplets of molten metal in a chamber. They were able to count the droplets solidifying as the chamber temperature was lowered. Certain of the droplets, free of impurities were found to remain molten well below the supposed solidification point for the metal under study.

Uses for Grain Alcohol By-Products

➤ A NEW fermentation process has been developed by the research laboratories of Hiram Walker & Sons, Inc., Peoria, Illinois, that greatly improves the vitamin content and utility of distillers' feed which are by-products of grain alcohol manufacture.

Not so many years ago the grain fraction remaining after alcohol distillation was a processing waste which created a serious disposal problem. Prior to the war, methods were developed for completely recovering these residues in dry form and they have since found wide usage in poultry, swine, and livestock feeding.

In the new method, the coarse grains are separated by screening after the alcohol has been distilled and the screened liquid called thin stillage is subjected to fermentation with the microorganism, *Ashbya gossypii*. This microorganism has properties in common with both yeasts and molds. During the fermentation, which is conducted with aeration in a manner similar to that used in producing penicillin and other antibiotics, the riboflavin (vitamin B_2) content is raised about one thousand times and other vitamins are substantially increased. The final product is a good source of the Animal Protein Factor and is the richest known source of another substance stimulatory to chick growth which has been tentatively termed, LBF. Distillers' feeds fortified with a small percentage of this fermentation product have been found beneficial in both practical and experimental chick rations and are currently being evaluated with other animals.

Dust in a dust-bowl laboratory, a room where the effects of dust in automobile equipment is studied, is sometimes kept in circulation by attaching fans or wide paddles to the jacked-up rotating wheels of the motor car.

Bile Acids Replace Osmium in Cortisone Synthesis

More and Cheaper Cortisone

➤ An improved method of synthesizing cortisone, which promises to increase the supply of the now scarce arthritis remedy, was announced by Dr. E. C. Kendall and four Mayo Clinic co-workers at the meeting in Chicago of the American Chemical Society.

The nation's seven million or so arthritis sufferers probably never have heard of osmium. This is a very hard, gray metal which gets its name from the strong odor of one of its oxides. But the smelly hard metal in one of its forms, osium tetroxide, has heretofore been necessary for the synthesis of cortisone.

Now Dr. Kendall and associates have found a way of making cortisone from bile acids without using osmium tetroxide.

"Cortisone may be made more cheaply and abundantly as a result," he declared.

Heretofore, he explained, "such large quantities of osmium were required and the supply was so limited that all pharmaceutical companies which would like to manufacture cortisone cannot secure the necessary amount of this rare element."

Osmium is not only expensive and rare but also toxic, so one part of the synthesis now followed required the recovery of all traces of osmium used in making cortisone.

Key to the preparation of cortisone is the introduction of a hydroxyl group into the proper molecular position. It must be attached to the seventeenth carbon atom in a pregnane derivative, which is extracted from cattle bile.

The new synthesis was accomplished by following precise chemical preparations of a series of intermediate compounds. The steps had to be delicately timed so that it was possible, through skillful manipulation, to remove the hydroxyl groups that entered the wrong positions, without removing the desired group. The success of this method is the culmination of four years of research work at the Mayo Foundation.

"The results could not be predicted," Dr. Kendall stated. "The achievement is a source of much satisfaction.

"The discovery of this series of intermediate compounds may be of no little significance in the large-scale production of cortisone. The sequence of steps can be applied to starting material other than that used in the work described in this paper and the ability to introduce a hydroxyl group at C-17 in derivatives of pregnane without the use of osmium tetroxide may remove a formidable block in the commercial production of cortisone."

Associated with Dr. Kendall in this work were Drs. Frank B. Colton, William R. Nes, David Van Dorp and Harold L. Mason.

Radioactive Cortisone

Cortisone made without osmium has been produced in a radio-active

form so that more can be learned about the path this drug takes through the body and, perhaps, how its acts to relieve arthritis and other ailments.

This feat was announced by Drs. T. F. Gallagher, Theodore H. Kritchevsky, David Fukushima, Bernard Koechlin and Max Eidinoff of Sloan-Kettering Institute and Memorial Hospital, New York.

Radioactive tritium was substituted for hydrogen in one stage of the synthesis to produce the radioactive cortisone.

Four other adrenal cortex hormones were prepared and were made also with the stable isotope of hydrogen, deuterium, in the molecule. These hormones are also expected to aid in the study of the part these hormones play in fighting disease.

Resinous Alcohol

➤A NEW liquid composition which will simplify and improve the process of varnish manufacture was announced by Dr. D. E. Floyd of General Mills, Inc.

"Resinous alcohol," as the new liquid is called, will eliminate the hazardous step in varnish making in which hard, solid resin is broken up and added to hot oil in huge cooking kettles. The settling of these solid particles to the bottom of the kettles results in charring of the resin and consequent darkening of the varnish, one of the most exasperating problems of the industry.

The new resinous alcohol, which takes the place of the solid resin, can be easily pumped into cooking kettles, making the laborious grinding job unnecessary. Because it mixes readily with the fatty oils in the kettles, agitation is not required, no material will settle to the bottom, and the possibility of ruining a large batch of varnish because of charring is completely eliminated, Dr. Floyd said.

The liquid cuts costs for varnish makers because it permits the use of inexpensive equipment, and it is more convenient and safer to use than solid resins.

Resinous alcohol is a stable, non-solidifying, non-drying liquid with about the consistency of molasses, although it becomes more fluid on being heated. It has a faint, agreeable, rosin-like odor and is pale amber in color. It withstands heating or freezing without damage and contains no solvent or other volatile material. Its physical and chemical properties are such that it is particularly adapted for use in preparing varnishes and alkyd resins for use in paints, enamels, and lacquers.

Resinous alcohol is a mixture of known varnish ingredients in a new resinous composition. Through the use of the new liquid, it is possible to incorporate three kinds of resin into a varnish. Varnishes and alkyd resins of high quality can be prepared in this manner from the resinous alcohol, soybean oil, and maleic anhydride.

Completely or Partly Digested Protein Helps Rebuild Tissues

Predigested Proteins

➤ PREDIGESTED proteins, administered by vein, may be employed successfully in long-term treatment of the sick and wounded, two Rutgers University chemists reported. These chemically digested foods, called protein hydrolysates, are of great value in cases in which proteins cannot be fed by mouth.

The Rutgers experiments, which were performed on dogs, also suggested that incompletely digested proteins are utilized as effectively as those completely predigested, and tend to be available for use in the body longer, according to Dr. John I. White and Dr. James B. Allison of the Rutgers University Bureau of Biological Research.

The work described was part of a broad program aimed at developing protein hydrolysates better able to rebuild body tissue in ill persons and animals. The compounds provide amino acids which are needed for the growth and repair of tissue.

Amino acids are the building blocks for body proteins, the chemical structures which form an essential part of living material. A bit of this material called protoplasm is organized into a microscopic unit of life, the cell. Groups of cells in turn form the tissues and organs of plants and animals. The heart, lungs, kidney, liver, nerve and muscles of the animal body are constructed from thousands of different types of these cells.

The body is then a well organized community of cells with mutually beneficial functions. The alimentary tract receives and processes foods, the blood and lymph serve as a transportation system to cells where processes of energy transfer, tissue building and waste removal are carried out under local as well as central control. These controls are a part of the nervous and hormonal systems. The body is thus a coordinated community with a continued interchange of raw materials, synthesized products, and waste substances—interchanges which biologists call a dynamic equilibrium.

Amino acids for growth and repair of body tissues are obtained from proteins from plant and animal sources in the diet. These food proteins are broken down in the digestive tract into amino acids which are absorbed into the blood stream, where the portal circulation carries them to the liver. Here the process of building body proteins is commenced.

There are some twenty-two amino acids needed by an animal to construct body protein. Most of these can be synthesized by the body from raw materials of food. Some amino acids, however, cannot be made fast enough to meet requirements for growth or bodily repair. These acids which cannot be manufactured in adequate amounts are called "essential" and they must be included in the daily diet to maintain the integrity of the living

cells. There are no storage depots in the body for amino acids; hence omission of the essential acids stops growth and results in the breakdown of body tissues, leading to many changes harmful to life.

Drastic changes in the animal body are associated with the lack of essential amino acids in the diet. Body proteins are continually being broken down through a process of disintegration called catabolism. However, when amino acids are supplied in the diet a building-up process called anabolism also takes place, permitting growth, the development of new cells and the repair of old ones. In the absence of adequate quantities of amino acids in the diet, the catabolic process is dominant, resulting in a depletion of the proteins in the cells and tissues of the body. Depletion in proteins is associated with most illnesses as well as with malnutrition. Thus the amino acids are very important in therapy.

In many disease processes it is impossible or undesirable for the patient to receive proteins by mouth. It is possible, however, to supply the need of the patient by infusing solutions of proteins into a vein. Since the normal digestive processes are by-passed, it is necessary to break down the protein chemically into amino acids before infusing the solution. This chemical "digestion" may be performed with inorganic acids or by use of natural digestive enzymes in purified form. Such amino acid solutions, called protein hydrolysates, have been used in human patients with very gratifying results. By helping to correct the protein deficiency associated with disease conditions they have aided in building up strength for operations, in speeding up healing of wounds, and in shortening periods of convalescence.

These clinical findings have stimulated much research in an effort to develop more satisfactory hydrolysates. Various proteins have been used and they have been digested to various degrees and by various methods. In an effort to evaluate the effectiveness of these hydrolysates, methods have been developed by several workers to determine how much of the infused amino acid mixture is actually used for building up body protein.

The present investigation was begun in an effort to determine whether efficiency of utilization of intravenously fed hydrolysates varied over an extended period of time. Two different proteins of blood origin, but differing in degree of chemical digestion and in nutritional value, were fed intravenously to dogs for periods up to three weeks. These hydrolysates were the only source of amino acids available to the animals. The dogs were fed by mouth a diet devoid of protein. In each case the animals were able to utilize the hydrolysates for protein synthesis as well at the end of the experiment as at the beginning. Their results are of interest not only in terms of long-term therapy but also because they confirm the validity of shorter tests used to evaluate protein hydrolysates in animals.

In another phase of the experiment the urinary excretion of breakdown products of proteins was followed on an hourly basis. The usual waste product of the breakdown of amino acids is a compound called urea. By determining the hourly excretion of

urea following intravenous feeding of different hydrolysates it was found that the catabolic phase occurred most rapidly after infusion of completely hydrolysed proteins. The phase took much longer when the protein was incompletely digested before being administered by veins. Incompletely digested proteins, however, could be utilized as well as mixtures of amino acids for building up body proteins, provided the fragments of protein were not lost in large amounts in the urine.

Protein Heat Measured

➤ AN IMPROVED heat measuring device which reflects temperature changes as slight as five millionths of one degree promises to aid research on cancer, Dr. Julian M. Sturtevant of the Yale University Department of Chemistry reported.

The instrument, known as a calorimeter, will be used to investigate chemical changes in body proteins by measuring the heat these changes produce. A calorimeter differs from a thermometer in that it determines the total amount of heat produced, whereas a thermometer indicates only the temperature.

A detailed study of the heats of protein reactions will be of help in improving our understanding of these biologically important materials. Cancer is a condition of abnormal growth and reproduction of certain cells in the body. There can be little doubt that any degree of comprehension of these abnormal processes, as well as of the processes of normal growth and reproduction, must await a tremendous increase in our knowledge of the proteins which constitute the bulk of the material, aside from water, in the living cell.

The accumulation and interpretation of information concerning the heats of the reactions undergone by these substances is but one phase of the vast scientific effort at present being concentrated on proteins.

All chemical reactions take place with the evolution or absorption of greater or lesser amounts of heat, which may be measured in a calorimeter. Reactions such as the combustion of coal or oil evolve large amounts of heat and are therefore of great practical importance. Other reactions involve only small heat changes which in themselves are of no great importance from a practical point of view, but which may nevertheless be of considerable significance in helping investigators to understand the nature of the processes taking place.

The calorimeter was designed particularly for measuring the heat changes which take place in reactions in solutions of proteins. The method which is employed can be readily adapted to other classes of substances. With this instrument it becomes possible to evaluate a heat change as small as 0.001 calorie per cubic centimeter of solution, with reactions taking as long as several hours to reach substantial completion. Twenty-five cubic centimeters (about one ounce) of solution are required for each experiment. This amount of heat would raise the temperature of a cubic centimeter of water only 0.0018° Fahrenheit. The temperature measuring device in the apparatus responds to changes as small as five millionths of a degree.

The reacting solution in the calorimeter is contained in a small metal can supported in an environment the temperature of which is automatically maintained equal to that of the solution to minimize heat losses. The chemical energy of the reaction is continuously and automatically duplicated by electrical energy, and the amount of the electrical energy is measured as a function of the time since the start of the reaction.

"AND WHILE *the experts concede that several H-Bombs might wipe out the Nation, greater damage may result from hysteria . . .*"

Wood Waste Feeds Cows

Molasses From Wood

by Don Brown

➤For the first time in the nation's history, molasses is being produced on a commercial basis from wood waste —in the heavy Douglas Fir region, Springfield, Oregon.

American chemists have known since before World War I that cellulose, which constitutes most of wood's structure, can be converted to glucose sugar solution by hydrolysis. But not until recent years did they know of the far-reaching results which could be obtained by feeding livestock a molasses that can be made from that sugar solution by boiling off excess water.

Under direction of specialists of the U.S. Forest Products Laboratory, Madison, Wisc., and others, and after a year of rehabilitation of the former war alcohol plant at Springfield, a process has been perfected for commercial production of wood molasses.

The first shipment of molasses was made to an Oregon dairy farmer, Charley McCulloch, who was thrilled with it.

"It took about 24 hours for my cattle to get used to the stuff," he said, "but after that they really went for it. I sprinkle it in amounts of from 10 to 15 percent by weight, over chopped hay and ensilage; and I even leave buckets of diluted molasses where they can take a drink when they want to. I wouldn't be without it now."

His feeding schedule follows recommendations made by the Agricultural Experiment Station of Oregon State College, Corvallis, Ore., where extensive tests and studies were conducted, beginning in 1948.

A summary of those tests, announced last year by I. R. Jones, dairy husbandman for the college, indicated four major considerations:

1. Wood sugar molasses diluted with water and sprinkled over low quality hay proved to be as palatable as cane molasses for dairy heifers.

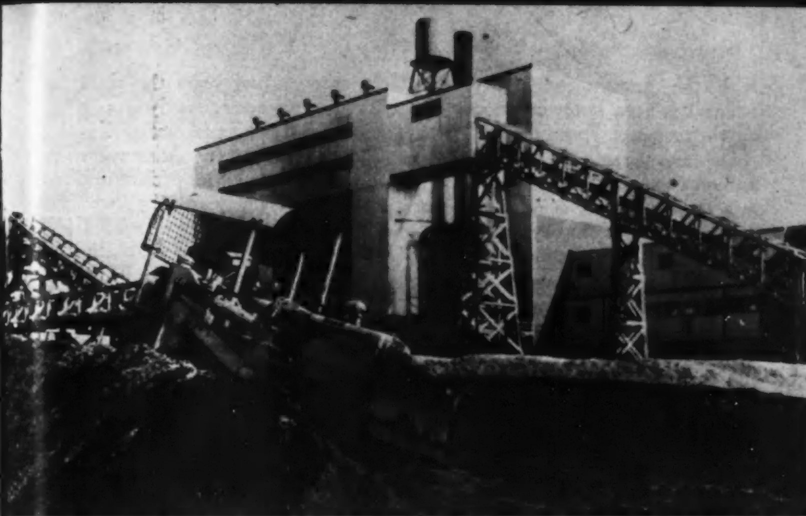
2. From the feed consumption records it has been calculated that 100 pounds of wood sugar molasses of 56 percent dry matter content is equal to 77 pounds of cane molasses with 74 percent dry matter.

3. Cows showed a slight preference for alfalfa ensiled with three percent wood sugar molasses to alfalfa ensiled with three percent cane molasses.

4. There was no appreciable difference in feeding value for dairy cows as measured by milk production and weight changes of alfalfa ensiled with wood sugar or with cane molasses.

Generally, similar tests conducted with sheep, beef cattle, hogs, horses, and chickens in agricultural schools at Michigan State College, Montana State College, Wyoming Agricultural Experiment Station, and Washington State College have proved as encouraging.

Significance of the new molasses-making process is tremendous, espec-



➤ A BULLDOZER *shoves wood waste from mills in the Eugene-Springfield area up to conveyor belts, where wood is taken to digesters for conversion into valuable molasses. Wood waste and lignin are also burned at the plant to furnish heat and electrical power.*

ially to the Pacific Northwest, where freight charges add to the cost of present molasses being fed to livestock.

It is significant also that there are 11,000,000 cords of Douglas Fir logging wastes in Oregon and Washington each year, according to U.S. Forest Service reports.

As Douglas Fir contains more than 50 percent cellulose on a dry basis, and it is this cellulose which is made into sugar, vast quantities of the new substance is scheduled to be made.

Briefly, the molasses process consists of pressure cooking wood chips with steam and dilute sulfuric acid, thus converting cellulose to glucose. The acidic sugar solution is then neutralized in milk of lime, and excess water is boiled off to make a 50 percent molasses.

With dry wood it is possible to make nearly 200 gallons of molasses from one ton of wood; a gallon of this weighs about 10 pounds—thus yielding a ton of molasses from each ton of wood. Half the weight is water, of course, necessary to dilute the molasses.

Douglas Fir sugar is black before refining and has a pleasant maple sugar odor. It is palatable and could be used for human beings; and although on a laboratory scale it has been refined white it will not be refined at Springfield at present.

Major use of the new molasses is for livestock feed as it comes from the evaporator, a neutralized sugar that is not as sticky as cane or beet molasses.

Leader in the new process is Dr. Elwin E. Harris, chemist specialist

with the government laboratory, which has been following closely the developments at Springfield.

Dr. Harris, recognized as a national authority on sugars in wood, as well as a skilled chemist in other fields of wood studies, has been at the Springfield plant at various times during the past year to lead research and coordination of the process.

When the new molasses was made recently, Dr. Harris said, "The nation and particularly the Northwest may now benefit from large-scale production of a sugar proved highly beneficial for livestock feed.

"It means, perhaps, packing houses for the Northwest and a whole line of by-product industries which stem from them. And it is most significant that a new substitute of great value has been recovered from wood which was largely wasted by burning for many years."

The plant contains five huge percolators, where hydrolysis of wood can be carried on. Each of those units is capable of producing more than 30 tons of sugar, by dry weight, per day.

The first trial run at the plant, made June 24, made four tons of sugar from 12 tons of chipped wood.

Molasses is but one of several products being made at the huge western plant, and but one of many which the plant is capable of producing.

Designed in 1943 as a producer of alcohol—190-proof "grain" alcohol—the plant was completed in 1947, and turned out a little less than 100,000 gallons of industrial ethyl alcohol. A drop in the alcohol market, plus operational difficulties which had yet to be solved, caused a shutdown of the plant under private management.

For over two years the plant lay idle, having been passed through the hands of the Reconstruction Finance Corp., War Assets Administration, and General Services Administration and was finally leased by two brothers, Charles B. and William S. Hudson, of Americus, Ga. Rehabilitation of the plant began in October, 1949, for molasses production.

But another new wood product discovery had been made at Corvallis, at the Oregon Forest Products Laboratory, by Dr. E. F. Kurth, chemist. This was that a high quality wax could be extracted by benzene from Douglas Fir bark, and equipment was set up at the Springfield plant for production of that wax. O.F.P.L. officials say there are 1,500,000 tons of available sawlog bark in Oregon and Washington each year.

In addition to wax from fir bark, the plant has been making a by-product of both the wax and sugar processes—lignin. Now the material is being stockpiled there, but several promises are held out for successful use of the material.

Lignin, the other major constituent of wood other than cellulose, is an evasive substance which has baffled chemists for many years. What its characteristics are in its natural state, chemists can only speculate.

But, as it emerges as a by-product, it is dark brown, powdery, and has a high carbon content. As a fuel it is superior to wood because this material has a fuel value of 10,500 B.T.U. per pound of dry material as compared to about 8,000 B.T.U. for Douglas Fir wood.

The lignin is being sold at Springfield as a mulch, because of its high

water retaining ability, chemical action having made it a kind of wood "sponge."

Other products which can be recovered from the chemical plant at Springfield include methyl alcohol, furfural, calcium sulfate, charcoal. These can be made from the wood sugar process.

In the wax division, it may soon be possible to manufacture tannin, for Dr. Kurth also has claimed discovery of an extraction process for taking high quality tannin from bark, along with wax.

According to Dr. P. M. Proctor, technical director of the Oregon Forest Products Laboratory, "Leather chemists have reported the new tannin is a premium extract, which produces an 'attractive' leather.

"And the oil industry has reported that Douglas Fir bark tannin is as satisfactory as the universally popular quebracho tannin for controlling viscosity of drilling muds in oil well drilling."

By the Kurth process, tannin may be leached from fir bark in hot water; and on a laboratory basis, at least, the bark yields from eight to 18 percent of tannin, based on dry weight of sound bark.

With some modification to existing wax-making techniques at the Springfield plant, tannin could be produced.

Alcohol manufacturing equipment at the plant is still intact from its wartime use; and it can be pressed into service within a short time for manufacture of vital alcohol.

The plant utilizes the five percent sugar solution which results from wood hydrolysis—for growing yeast and producing alcohol. Plant operators at present, however, are concentrating on making molasses from the solution because of the more favorable financial gain.

If war makes it necessary to revitalize the alcohol production, a whole list of chemicals can then be recovered by the alcohol process—carbon dioxide, butylene glycol, acetic acid, and lactic acid.

Enzyme Theory of Odor

➤ A NEW THEORY of how the sense of smell works has been developed by Dr. G. B. Kistiakowsky of Harvard University.

Odors work through enzymes, he believes. Enzymes are a class of chemicals which can produce the transformation of other chemicals. Many vital body processes go on through the mechanism of enzymes. Pepsin, a digestive enzyme, is one familiar example.

You get the odor of a chemical because it changes the concentration of one or more enzymes. The change in enzyme concentration produces a signal in certain nerves. The intensity of a smell is related, according to this theory, to the extent to which the enzymes are checked or blocked in their action.

The persistence of certain odors may be due to a non-reversible change in the blocking of enzymes, though most of the enzyme blocking is reversible.

For The Home Lab

Antimony

by Burton L. Hawk

➤ Antimony has been known since 3000 B.C. Indeed, according to ancient historical lore, the Oriental women used the metal to beautify their eyebrows. And we thought the use of cosmetics was a modern trend!

No one knows who discovered antimony, but the first investigation of its properties is accredited to Basil Valentine, who wrote a book on the subject entitled, "The Triumphal Chariot of Antimony."

The Metal

Antimony is found chiefly as the *stibnite*, which is a trisulfide, Sb_2S_3. The metal is silvery-white with a brilliant luster. It is more readily available commercially in the form of powder and we shall use this as our starting point.

The metal melts at 630°, and you will be able to reach this temperature easily with a blowpipe. Place a small quantity of the black, powdered antimony in a small hole in a charcoal block. Direct the blowpipe flame on the metal, blowing with inflated cheeks to insure a steady flame. Pour the melted globule on a sheet of white paper. It will break up into several miniature balls which will roll over the paper in various directions, each forming a track of charred paper behind it. Also, you can observe the silvery appearance of the solid metal in contrast to the black powder.

The Trioxide, Sb_2O_3

Antimony powder will burn in air or oxygen with a bright light to form the trioxide. Sift a small quantity of the powder into a flame to observe this reaction.

This oxide is also obtained by the action of nitric acid on the metal. Add a small portion of the powdered metal to dilute nitric acid and heat gently. Soon a miniature "snowstorm" is formed consisting of particles of antimoney trioxide.

Antimony is one of those annoying elements that we call ***amphoteric***, meaning that its hydroxide acts either as a base, $Sb(OH)_3$, forming salts such as sodium meta-antimonite, $NaSbO_2$; or as an acid, H_3SbO_3 forming compounds such as antimony trichloride, $SbCl_3$. There are several elements which act this way just to make life confusing for chemistry students.

Sodium Meta-Antimonite, $NaSbO_2$

Filter off the precipitated trioxide and dissolve a small portion of it in sodium hydroxide solution, heating if necessary. The resultant solution is sodium meta-antimonite. It is strongly hydrolyzed and reacts with water to form a solution of sodium hydroxide and antimonous acid.

Antimony Trichloride, $SbCl_3$

By dissolving the trioxide in hydrochloric acid, the trichloride is formed. This substance forms large, soft crystals and is sometimes known as "butter of antimony." It is also hydrolyzed and reacts with water to form the insoluble antimony oxychloride, SbOCl

Antimony Pentachloride, $SbCl_5$

The pentachloride is formed in a fascinating reaction involving the direct union of the elements. Prepare a tall cylinder of chlorine gas. Chlorine gas may be generated by heating dilute hydrochloric acid with manganese dioxide in a flask to which is attached a one-hole stopper and delivery tube. Allow the gas to flow through the delivery tube into an empty cylinder. When the cylinder is filled, as you can observe, cover with a glass plate and disconnect the generator. Now, remove the plate and sift finely powered antimony into the cylinder of chlorine. As each particle falls it will burn with a flash of light.

Antimony Trisulfide, Sb_2S_3

This substance is found in nature as a black powder, but can be precipitated in the laboratory as an orange-red powder. To prepare the black sulfide, simply heat together equal portions of powdered antimony and sulfur. When all reaction has ceased, remove the mass and powder in a mortar. To form the beautiful orange-red variety, dissolve a small portion of the black sulfide in dilute hydrochloric acid. This forms antimony trichloride, as prepared previously. Now bubble hydrogen sulfide into the solution. Gradually the orange-red precipitate appears. (The hydrogen sulfide can be generated by adding dilute hydrochloric acid to iron sulfide).

Antimony Pentasulfide, Sb_2S_5

When antimony trisulfide is dissolved in yellow ammonium sulfide, the pentasulfide is formed upon the addition of acid. Technically, for those who are interested, the soluble ammonium thioantimonate is first obtained. Upon addition of acid, thioantimonic acid is formed which rapidly decomposes and antimony pentasulfide is thrown down as an orange precipitate.

Tartar Emetic

This well-known compound is obtained by heating antimony trioxide with potassium bitartrate. It is a basic salt, $K(SbO)C_4H_4O_6$, used in medicine as an emetic and expectorant.

Competition Improves Cotton Fiber

➤ King Cotton, whose empire was shaken by the cellulose revolution that brought rayon and nylon into high public favor, is making a bid to win back some of its competitive advantage with the development of new strong-fiber varieties.

Years of plant breeding and research have produced several new types with a much higher fiber strength than any cotton now grown. Thanks to these improved types, cotton can now compete more favorably with the synthetic fibers, states Dr. Charles R. Sayre, a Department of Agriculture research head.

Some of the varieties are so new they have not yet been released, but several, including two American-Egyptian hybrids and a high-test-fiber Asiatic-American cross, are available commercially.

The new cottons, by providing better fibers at lower costs, may supply the key to more varied and efficient farming in cotton growing areas.

Poisons, Acid Burns, Fire, Shock, Cuts, Lab Hazards

Teach Safety in Chemistry Courses

➤ SAFETY INSTRUCTION should be made an integral part of all high school and college chemistry courses, H. H. Fawcett of the General Electric Company, Schenectady, N. Y., declared at the American Chemical Society's recent meeting.

Citing the numerous hazards associated with laboratory operations, Mr. Fawcett said:

"Appreciation of safe practices and the proper respect for chemicals are as important as the formal knowledge which the student is expected to absorb."

Poisoning, chemical burns, fire, electric shock, and glass cuts are the five worst laboratory hazards, Mr. Fawcett told a symposium on industrial health and safety, and, of the five, toxicity is probably the most pernicious and least commonly appreciated. Few college courses include more than superficial references to poisoning, possibly because its seriousness was not recognized until recent times, he asserted, yet silica, lead, mercury and benzene, to mention four examples, have claimed many lives.

It is a mistake to assume that laboratories escape toxicity problems simply because smaller quantities of chemicals are involved, he warned.

Fumes from one cupful of carbon tetrachloride breathed in a poorly ventilated area may cause death, while one teaspoonful of this solvent has been fatal when swallowed.

Chemical burns are usually dramatic, painful, and slow to heal, and hence the severity of such burns is commonly realized, but not all laboratory workers fully appreciate how burns from one kind of acid differ from those caused by another.

"Exact treatment for a particular exposure is extremely vital, as was emphasized several years ago at an Eastern women's college," Mr. Fawcett pointed out. "A coed had burned herself with concentrated sulfuric acid. She suffered more from the 40 per cent sodium hydroxide which misinformed people applied to her burns than from the acid. A lawsuit awarded her several thousand dollars for the resulting facial disfiguration."

Fires and explosions have occurred often enough in laboratories so that fire prevention is usually recognized as a necessary part of running a laboratory, but there are enough flammable solvents lying around almost every laboratory to produce a holocaust, and younger chemists do not always appreciate the potential fire hazards with which they are working. Moreover, the never-ending parade of new compounds and mixtures continually poses new problems in fire protection as well as in toxicity and burns.

Although electric shock usually is associated with high voltage work in physics, Mr. Fawcett said, low voltages used in chemical laboratories may be equally lethal. A current of as little as 5 milliamperes—far less than is needed to light an average household bulb—may be fatal.

Glass cuts constitute an ever-present threat in the laboratory, and even experienced chemists occasionally suffer severe lacerations. The experience of one large university suggests that there is one serious hospital case from glass cuts for every 400 students during the first three laboratory periods of sophomore chemistry, he reported.

"Glass is especially violent when under pressure or vacuum, there being several cases on record of flying pieces of glass puncturing through to the heart as laboratory apparatus exploded."

In view of the nature and extent of the hazards inevitably found in the laboratory, accident prevention should confront the student in high school chemistry and extend through college to industrial work, the speaker declared. He commended several professors who have integrated safety into their regular courses, and urged others to follow their example.

Mr. Fawcett also stressed the need for proper physical facilities in the laboratory, including secondary exits for emergency use. Adequate ventilation and illumination, smooth flooring, grounding for electrical apparatus, and mechanical guarding of belt-driven equipment also are important.

New Seal Improves Radio Tubes

➤ A NEW METHOD of sealing ceramics to metal offers many advantages in producing tiny radio waves a few inches in length, Dr. C. G. Suits of General Electric has announced. The seal is made by an alloy of silver and titanium.

Most radio tubes, such as those used in ordinary home broadcast receivers, are now made of glass, though some are made with metal envelopes. However, those used for microwaves have much more severe requirements. The tubes themselves must be small, which means that they must operate at high temperatures. This introduces trouble with glass.

A ceramic material, however, seems to meet the difficulties. A type must be used which is strong and retains good insulating properties even when hot. Methods ordinarily used for bonding metal and glass cannot be used with ceramics.

The new technique was developed in the ultra-high-frequency section of General Electric Research Laboratory by R. J. Bondley. The process is carried out in a vacuum at high temperature, which effectively drives out gases in the metal and ceramic parts. This simplifies final evacuation of the tube. The method may be used to join two pieces of ceramic as well as to make a ceramic-to-metal seal.

New Chemical Inventions

To obtain any patent, order by number from the Commissioner of Patents, Washington 25, D. C., enclosing 25 cents in cash, money order or Patent Office coupon, but not stamps, for each one.

Simplified Gold-Plating

➤ METALS ARE PLATED with gold by mere immersion, without heat or electrolytic action, in a process for which patent 2,501,737 was awarded to Ralph W. Porter, Jr., Cambridge, and Clifford M. Jones, Chelsea, Mass. An even coating is obtained, they claim, and no buffing is required.

One of the applications to which the invention can be put is in the plating of grids of radio tubes and other electron discharge tubes. It can also be used to plate the inside of a hypodermic needle.

The inventors found that various metals, such as nickel, tungsten and molybdenum, can be plated with gold by immersion in the solution used by them. It contains distilled water, gold chloride, sodium phosphate, potassium cyanide and acetic acid. When nickel is to be plated, nickel chloride or nickel carbonate is included.

White Pigment

➤ TITANIUM DIOXIDE, widely used as a pigment to make white paint, is produced by an improved process discovered by Holger H. Schaumann of Newark, Del. He received patent 2,502,347, rights for which have been assigned to Du Pont Company of Wilmington. In his process the titanium dioxide pigment is obtained by reaction of a titanium halide vapor with an oxygen-containing gas.

Rubber Cement

➤ A RUBBER CEMENT, consisting of an alcoholic dispersion of reclaimed rubber in ethyl alcohol including shellac, received patent 2,501,654, the recipient being Stewart L. Brams, Dayton, Ohio. The patent has been assigned to General Motors Corporation, Detroit. One of the advantages of this cement is its quick drying properties.

Odor-Absorber

➤ AT LAST THERE is relief for the housewife from the odor of hubby's smelly pipe which he "carelessly" leaves lying around. It is an odor-absorbing charcoal-filled capsule which is stuck into the bowl when the pipe is not in use. The inventor is Richard J. Valentine of Claremont, Calif. The patent number is 2,502,292.

Self-Sealing Fuel Tank

➤ IN THE FUEL tanks of combat planes, materials are used as a lining which will make a quick seal before the container hit by a bullet loses much of its contents. The inner layer is a rubber-like material which is resistant to the fuel in the best known self-sealing tanks. In a self-sealing layer patented this week, a textile fiber coated with cellulose is employed.

Patent 2,500,158 was awarded to William Alexander Dickie and George Rudorf, both of London, England, for

this invention. The patent has been assigned to Celanese Corporation of America, New York City.

These scientists found that certain cellulose derivatives are particularly suitable for the construction of sealing layers in gasoline tanks, they state. Cellulose acetate-stearate of high ester content is recommended. The textile fabric to be impregnated with the cellulose derivative is preferably wool because wool has a good degree of resiliency.

Industrial Waste Waters

➤ INDUSTRIAL waters, which become contaminated with oil and dirt in the process in which employed, can be cleared for re-use over and over again by relatively low-cost equipment awarded a patent.

This apparatus for treating polluted liquids has brought William A. Gehle, Arlington, N. J. patent 2,502,-142. Its primary use is to remove fatty materials and dirt from water to reclaim the oil as well as purify the water.

Actually, it is an improved type based on an earlier patented apparatus. This type is more effective, and solids collected are easily removed without a radical shut-down and emptying period and deposit removal by hand. There are no moving parts in the equipment.

The device uses an elongated box-like separation chamber, but it is a box with a sloping bottom. The surface of the water passing through the chamber is practically level, but the water is much deeper at the exit end than at the other.

On the sloping bottom of the chamber are a series of cross-wise ridges and valleys to break an even flow. Gravity causes the separation. Oil is drawn off the top, and sand and solids collect at the lower end of the sloping bottom. Clear water is drawn from near the center of the exit end of the box.

New Magnetic Alloy

➤ IMPROVED electrical equipment using alternating current is promised with a magnetic alloy awarded a patent. The alloy is particularly suitable for use in the laminated cores of such apparatus.

It contains approximately 63% iron, 35% cobalt and 2% chromium, as well as a trace of carbon. It develops its desirable magnetic properties after being subjected to a heat treatment at 725 to 775 degrees Centigrade in a non-carburizing and non-oxidizing atmosphere. It has high resistivity and excellent workability.

Alloys of iron and cobalt have good magnetic properties for such applications but are brittle and difficult to roll into sheets to be punched to shape to form laminations. The addition of the chromium and the heat treatment remedy this defect, it is claimed.

Patent 2,512,358 was issued to Robert K. McGeary of Pittsburgh, Pa., for this invention. Rights have been assigned to Westinghouse Electric Corporation, East Pittsburgh.

Improved Refrigerant Fluid

➤AN IMPROVED fluid for use in refrigeration and air-conditioning systems brought Winston Harrison Reed, Syracuse, N.Y., patent 2,511,993. Carrier Corporation of the same city has secured the rights. It is a mixture of propane with a chemical well-known

to scientists which technically is monochlorodifluoromethane.

The mixture is azeotropic, which means that it boils at a constant temperature as if it were composed of a single substance. An official of Carrier recently stated the new fluid would meet refrigeration capacity and horsepower requirements of 17% to 18% more than Freon-12 for a given compressor displacement.

Oil Well Aids

➤ AN ELECTRICAL heating device for use in petroleum wells to make oil recovery easier, and what might be called the use of electronics in "logging" a well, are two separate devices for which patents were issued. Both are of particular interest in the oil industry, but the general public has a strong interest in anything that adds to the supply of liquid fuels, whether gasoline or heating oils.

Patent 2,512,226 was awarded to John Alton Edwards of Yucaipa, Calif., for the heating apparatus. It is particularly for use in shallow wells producing petroleum of low specific gravity in which there is a tendency for the contained wax and tar to solidify and stop flow. It can be used also in flow lines.

Logging a well refers to the determination of the nature and location of the underground formations through which the bore hole passes. Patent 2,512,020, issued to Gerhard Herzog, Houston, Texas, is what he calls a radiological well logging device. Rights have been assigned to The Texas Company of New York City. In his method he passes a source of neutrons through the bore hole. These, in pentrating the walls, release gamma rays. Comparative gamma ray measurements give the desired information.

Bending Glass

➤ A NOVEL METHOD of bending sheets of glass for modern automobile windshields and other purposes is of particular interest at the present time because of the increasing number of rounded shields coming into use. In this process, sheets can be bent singly or in pairs in the making of laminated safety glass.

In older methods, the sheet of glass to be bent was placed over a concave mold, and heat was applied until the glass softened and sank over the mold to take its shape. In the new method, no mold is used. The glass sheet is put horizontally with its two edges bolted to cylindrical rollers. Weights suspended from the rollers would cause them to approach each other if not held apart by the glass. However, when the glass is softened by heat, it sags and the rollers move. When the proper curvature is acquired, the glass is cooled.

Patent 2,500,278 was awarded to Donald W. Dunipace, Toledo, Ohio, for this process. Patent rights have been assigned to Libbey-Owens-Ford Glass Company of the same city.

Fire Extinguisher

➤ FIRE EXTINGUISHING method and apparatus has earned Leonard D. Myers, Washington, D.C., patent 2,500,428, rights for which are assigned to Cardox Corporation, Chicago. It uses carbon dioxide, and mechanical foam with the bubbles of the foam filled with carbon dioxide. In action, a sudden release of liquid carbon dioxide lowers the temperature sufficiently

to form a discharge stream of snow and vapor. Carbon dioxide is diverted from the stream to mix with water and a foam-stabilizing agent to create the mechanical foam.

Smoke Detector

➤ EARLY WARNING of fire in remote compartments in a building, ship or airplane is possible with a photoelectric smoke detector which received patent 2,513, 283. The inventors are Clarence Noel Cahusac, Newark, and Donald A. Diehl, Arlington, N. J. Patent rights have been acquired by C-O-Two Fire Equipment Company of Newark.

It is a tubular affair, containing a photoelectric element within the tube which itself is perforated with holes to permit the passage of air through it. Smoke particles in the air weaken the illumination of a beam of light to the photoelectric element, causing an alarm to be sounded.

Transparent Fabrics

➤ A CHEMICAL process for making rayon, cotton or nylon fabrics transparent was patented by Ernest Weiss of Bunt, Wattwil, Switzerland. Unlike oilskins, the finished fabric after treatment with various resins remains open-meshed and porous. Rights on patent 2,510,919 covering the process are assigned to the Heberlein Patent Corp. of New York.

Boron-Treated Steel

➤ A BORON-TREATED molybdenum steel, for which an English inventor received an American patent, is claimed to be an improved steel which possesses high maximum and yield stress characteristics without introducing appreciable hardening characteristics. Usual incorporation of boron into steel is to increase depth hardenability.

The inventor is William Edward Bardgett, Sheffield, England. Rights are assigned to the United Steel Companies, Ltd., of Sheffield. Patent number is 2,513,395.

Tannin From Nut Skin

➤ THE INSIDE skin which lines many nutshells and partitions the nutmeat is rich in tannin, the strong astringent substance used in curing leather. Patent 2, 510,119 was granted to Elbert C. Lathrop of Peoria, Ill., for his new method of separating this material from the nutshell proper. The trick is turned by shock or impact, as in a hammer mill. The tannin-bearing material falls away as a soft powder, easily separated by screens from the larger shell fragments, which may then be used, the inventor says, as soft-grit blasting material or as a light-colored filler for plastics or abrasive hand soaps. The invention is turned over to the U.S. government, royalty-free.

Antiseptic and Insecticide

➤ THE DISCOVERY that a chemical compound known as 2,3-diphenyl indole is both an effective antiseptic solution and an effective insecticide against mosquito and carpet beetles brought William D. Stewart of Yonkers, N.Y., patents 2,510,428 and 2,510,432. As an anti-bacteria agent the compound may be used in shaving creams, soaps and other cosmetics, the inventor claims. As protection against the carpet beetle, woolen fabrics may be impregnated with the chemical. The B. F. Goodrich Co. was assigned patent rights on both.

Gas Mask Carbon

➤ An improved method of rendering carbon filters impervious to poison gases was patented by Jacque C. Morrell and George T. Tobiasson of Chicago. The invention was assigned royalty-free to the U.S. government. Three patents, 2,511,288 to 2,511,290 were assigned to the invention.

In the new process, carbon filters are impregnated with small amounts of silver, copper and sodium compounds, which increase the ability of the filters to absorb gases and vapors from the air.

Maple Sirup Flavor Not in Tree Sap

➤ The delicious flavor of real maple sirup (spring is not far off even in Vermont) is actually not present in the sap as it is collected from the trees, three U.S. Department of Agriculture chemists reported to the Philadelphia meeting of the American Chemical Society.

The prized flavor is developed during the traditional processing of the sap to sirup through the browning reaction, they discovered in tests at the Eastern Regional Research Laboratory at Philadelphia.

By using other and seemingly more efficient methods of making the sirup, an essentially flavorless product can be made. Such disappointing methods as low temperature evaporation either by distillation or by freeze drying gave the clue to the fact that organic acids may enter into the reaction that produces the flavor.

The chemists in the investigating team were: Drs. William L. Porter, Charles O. Willits and M. L. Buch.

Growing Plants Clue to Metal Deposits

➤ The prospector for new metal deposits of the future will go about collecting living plants, analyzing their leaves and stems, in order to detect the hidden deposits that lie underground.

Dr. Paul Weaver, chief geophysicist of the Gulf Oil Corporation, predicted to the American Chemical Society's Houston meeting that important new ore deposits would be discovered through this new sort of geo-botanical-chemical prospecting.

Certain plants are selective in concentrating certain metals. Selenium, for example, if located below the surface but fairly near it would be dissolved in the ground water. Any protein-building plant will take selenium from the water and use to replace the usual sulfur. Tumbleweed is such an accumulator of selenium and could be used to detect underground deposits.

Rocks containing metals in small concentration could be utilized as sources of metals when chemists develop new techniques of processing.

Lower Grade Civilian Products Necessary If War Is Extended

War Demands For Petroleum

➤ IN case of extended war, leading petroleum producers and users at a meeting of the National Petroleum Association foresee no likely shortages but civilians may have to use lower-grade products.

The military need for high octane components for aircraft gasoline will lower the octane level of certain motor gasolines, according to C. M. Larson of the Sinclair Refining Company, New York City. Any national emergency requirements for certain components of other petroleum fuels will restrict or change such fuels for commercial and civilian usage.

The all-out war need for large quantities of jet fuel will cut deeply into the kerosene, range oil and other fuel production. The jet fuels require components used by diesel bus engines, in farm tractor distillate fuel, range and space heater fuels and for many other purposes.

Future emergency requirements of military fuels, such as high-grade aviation gasoline and jet fuels, would have an effect on the composition of motor gasoline, in the opinion of Maj. Ray W. Whitson, Munitions Board Petroleum Committee, Washington, D.C.

During an emergency it becomes necessary to remove alkylate, catalytically cracked gasoline and other high octane number components from civilian motor fuels to produce more high-grade aviation fuel. It is necessary to remove straight run from civilian motor fuel, kerosene and diesel fuel to produce more jet fuels. Motor fuel, both military and civilian, will consist of those components not required for aviation fuels.

A brighter note in regard to the total supply is struck by Dr. Gustav Egloff, Universal Oil Products Company, Chicago. The oil industry is producing 3,000,000 barrels a day of motor fuels, and another 500,000 barrels a day could be produced from a million barrels of crude oil production which is now shut in. The oil industry can supply any demand made by the Armed Forces for motor fuels, and the chemical industry can also supply antioxidants, metal suppressors and tetraethyl lead.

Oil Shale For Future Fuel

➤ COLORADO oil shale which may some day be a major source of liquid fuel for the nation contains little or no oil in its natural state, according to a report by four Bureau of Mines investigators. Laboratory studies of selected samples showed that shale is composed of organic material and minerals, the organic matter being the part which yields oil when sufficient heat is applied, said the report prepared by I. C. Frost, K. E. Stanfield, W. S. McAuley, and H. N. Smith of the Bureau's Petroluem and Oil-Shale Branch at Laramie, Wyo.

Oil-shale deposits of the Green River formation exist over an estimated

area of 16,500 square miles in adjoining portions of Colorado, Utah, and Wyoming, the paper pointed out. These deposits constitute a potential source of liquid fuel which is estimated at 300 billion barrels of oil, or several times our known petroleum resources. The richest and most accessible oil shales of this formation are in western Colorado. A laboratory investigation has been made of six selected samples from this area.

The study showed the oil shale to be finely laminated sedimentary rock ranging in color from a gray-brown for the leanest sample to a very dark brown for the richest sample. The shales contain little or no oil as such, but are composed of organic material and mineral matter. The organic matter decomposes when sufficiently heated, as in retorting, to form shale oil, gaseous hydrocarbons, and residual organic material. The shales were similar as to the types of organic and inorganic matter which they contained but varied widely in the amount of these materials. The yields of the assay products—oil, gas, and residual organic in the spent shale—were related to the total organic content or richness of the shale. The degree of conversion of this organic material to the assay products was not greatly affected by the richness of the shale.

Specific gravities, bulk densities, and gross heating values of the shales were related to their oil yields and may be used as a rapid method of estimating the oil yields of similar shales.

The compositions of the assay gases were quite similar and indicated that differences in the amounts of the organic and inorganic constituents in the oil shales did not have a pronounced effect upon the composition of the assay gases.

The elements carbon, hydrogen, sulfur, oxygen, and possibly nitrogen were present in the raw shale in both inorganic and organic forms. This complex mixture made the ultimate analysis of the organic portion a difficult analytical problem, which has not been entirely solved.

The mineral portion of the shales contained silica, iron, aluminum, calcium, magnesium, sulfur, sodium, and potassium. In addition, many other elements were detected in amounts ranging from a trace to a few hundredths of a per cent. These minor elements do not appear at present to be of potential value as by-products of an oil-shale industry.

Natural weathering did not cause significant reductions in the oil yields of the shales for periods up to six months, but longer weathering periods resulted in decreased oil yields and increased water yields. The weathering was more pronounced for the rich oil shales.

Flame Studies Improve Gas

➤ Better anti-knock gasoline is promised by a series of "cool flame" studies described to the American Chemical Society's meeting by Dr. M. R. Barusch and J. Q. Payne of the California Research Corporation.

Cool flame is the name applied to a feeble blue light, which is given off by the chemical change occurring when a fuel and air mixture is heated as in an engine just before combustion, it was explained.

The California chemists have dis-

covered a relationship between cool flame behavior and the octane number of a fuel which indicates that knocking in an engine is caused by cool flames, the report said. Consequently, they believe, when cool flames are controlled the problems associated with knock will also be controlled.

Work now under way on the nature of the chemical steps occurring in cool flames should greatly add to our fundamental knowledge of combustion as well as knocking.

This will enable the chemist to improve greatly the quality of all fuels, thus affording better performance and economy to the consumer.

Noting that the performance of an automobile on the road is extremely sensitive to the quality of gasoline used, the scientists state that knowledge of the details of gasoline combustion forms the chief tool by which the petroleum chemist can lead the way to superior fuels. To operate the common internal combustion chamber where it is ignited by a spark, the hot gases push on the piston so that a portion of the heat is converted to the useful work of driving the engine. The amount of power obtained from the gasoline depends upon how much heat is evolved when it burns, the manner in which it burns, and how rapidly the combustion occurs. Thus, the kinds of chemical reactions that occur during the burning determine the performance of an engine.

If undesirable reactions take place during combustion, the phenomenon known as knock may result. When knock occurs, the efficiency of the gasoline is reduced so that less usable power can be obtained from a given amount of fuel. In extreme cases, knock can destroy an engine. The tendency of a gasoline to resist knock is measured by octane number. Fuels of high octane number tend to knock less than those of low octane number.

As fuels of higher octane number become more available it is possible for engine designers to produce more efficient and more powerful engines. Improvements in the octane number of fuels can be accomplished in two ways. First, the chemical composition of the gasoline may be altered so that the fuel will have improved burning qualities. Second, a small amount of foreign substance known as an additive may be dissolved in the gasoline. This additive will suppress the chemical reactions which cause knock. Tetraethyl lead is such a substance.

To find new ways to improve further the quality of gasoline it is necessary to understand more than is now known about the chemical reactions that occur in the engine. After the combustible gases are introduced into the cylinder, they are compressed by the piston. This compression causes the vapors to rise in temperature and this in turn can cause chemical changes to occur before the fuel burns. These changes can best be studied in the laboratory.

If a mixture of fuel vapors and air is gradually heated together, no reaction occurs for a relatively long period of time. Then slowly a chemical change begins to take place. The speed of this reaction rapidly increases to a very fast maximum. When the rate of the reaction reaches this maximum, a feeble blue light is emitted.

This blue luminescence is called a cool flame because it appears to be a faint flame, yet generates very little heat. The reactions which give rise to the cool flame consume only a relatively small amount of the fuel. Following the appearance of the luminescence, no changes are apparent for a short time and then spontaneous ignition may occur. At this point a normal flame is visible and complete burning or explosion of the fuel results.

Dr. Barusch and Mr. Payne of the California Research Corporation have been studying the cool flame reactions of gasolines, and the pure chemicals which make up gasoline, in an effort to determine the significance of these reactions. They have devised an apparatus of glass into which a mixture of gasoline and air is introduced, so that cool flames may be obtained and stabilized. The equipment consists essentially of a long straight tube contained in a carefully thermostated furnace. The fuel-air mixture is passed through the tube at an accurately controlled rate. At the inlet of the tube little chemical change occurs, but as the vapors flow along, reaction occurs at an accelerating rate, resulting in the appearance of the cool flame. So little light is emitted by the cool flame that it is visible only in a darkened room. The rate of flow is adjusted so that it exactly equals the speed at which the flame attempts to travel down the tube. Consequently, the faint glow becomes stationary in the tube.

A number of the chemicals which commonly occur in gasoline were studied in this equipment, the report said. The surprising finding was made that, under a given set of conditions, the position that the cool flame occupied in the tube correlated with the octane number of the fuel as determined in an engine. Materials having high octane numbers resist cool flame formation, thus giving a flame near the exit of the long tube, whereas chemicals of low octane number produce cool flames close to the fuel-air inlet. This discovery may be taken as an indication that knock in an engine is caused by the occurrence of cool flames. When cool flames are controlled the problems associated with knock will also be controlled.

The most important point of this work, however, is that the cool flame sets the stage for knocking and is thus in a manner of speaking responsible for knock. The cool flame reaction is but a small part of all the varied chemical reactions of combustion. Hence, to localize factors affecting knock control into this cool flame reaction should greatly simplify the determination of the chemical reactions of knock.

Tracer For Gas Synthesis

➤ Radioactive alcohol made available by the Atomic Energy Commission has helped to explain the mechanism by which synthetic gasoline is produced from coal.

Specifically, the radioactive alcohol has been employed to clarify the operation of iron as a catalyst, or accelerator, in fuel synthesis, according to a report by J. T. Kummer, H. H. Podgurski, W. B. Spencer and P. H. Emmett of the Mellon Institute of Industrial Research, Pittsburgh, Pa.

The Fischer-Tropsch synthetic fuel process developed in Germany a quarter century ago required the use of a

metallic catalyst such as cobalt, iron, or nickel. Cobalt was used during World War II in the production of large amounts of synthetic gasoline for the axis forces.

In the United States, interest has centered on the use of iron catalysts, the report states. Research work in this country has been directed partly toward the immediate commercial utilization of such a process and partly toward a study of the catalysts that are essential to the successful operation of the process. The present summary reports one experimental research designed to throw light on the mechanism by which the iron catalysts operate.

For a number of years, some of the research workers in the field of synthetic gasoline have postulated that the two gases, carbon monoxide and hydrogen, combine on the surface of the catalyst to form some of the simple alcohols and that these alcohols then serve as starting points for building up the hydrocarbon molecules such as are present in gasoline, kerosene, lubricating oil and wax. Others believe that the alcohols are formed simultaneously with the higher hydrocarbons but do not actually serve as forerunners of the hydrocarbons. As soon as radioactive ethyl alcohol became available through the Atomic Energy Commission, a series of experiments to try to settle the question as to the part played by the alcohols in the catalytic synthesis of hydrocarbons was undertaken.

The idea of the experiments is very simple. One merely adds radioactive ethyl alcohol to the carbon monoxide-hydrogen mixture being passed over a catalyst and analyzes the hydrocarbon formed for radioactivity. If the radioactive ethyl alcohol molecules are capable of attaching themselves to the surface of the iron catalyst in such a way as to constitute starting nuclei for building up higher hydrocarbons, one would expect to find one radioactive group per hydrocarbon molecule formed. Equal standard volumes of the gaseous hydrocarbon products (for example one cubic inch of vapor at 450 degrees Fahrenheit and one atmosphere pressure) would then have equal radioactive contents regardless of whether the hydrocarbons in the sample contained 2, 3, 4, or 10 carbon atoms per molecule.

The results show that each standard unit volume of hydrocarbon vapor had the same radioactivity regardless of the number of carbon atoms in each molecule. Presumably, therefore, ethyl alcohol molecules are capable of adhering to the catalyst surface and serving as starting points for building up higher hydrocarbons.

In the present work, it has been possible to show not only that ethyl alcohol molecules can act as starting nuclei in the catalytic hydrocarbon synthesis, but that the added carbon atoms build predominantly on to only one end of the alcohol molecule.

Such information helps better understanding of the way in which catalysts of this kind operate. When the time comes to supplement our petroleum supply by making synthetic gasoline, the sum total of such fundamental studies will enable us to design more efficient commercial processes for gasoline synthesis than have developed up to the present.

Better catalysts for the Fischer-Tropsch synthesis have been developed through the use of a new analytical procedure involving the heavy hydrogen isotope, deuterium, it was announced in another paper by H. I. Weck, S. Meyerson, and H. S. Seelig of the Standard Oil Company of Indiana, Whiting, Ind. at the recent ACS meeting.

The use of deuterium permits the measurement of the rate at which a catalyst wears out in use, and has already resulted in the development of improved catalysts for the conversion of coal into synthetic gasoline.

Analysis of the rate of deterioration of the catalyst requires the measurement of the carbon present as iron carbide. To be measurable, this carbon must be converted into a hydrocarbon by reaction with hydrogen in some form. Substituting the hydrogen isotope, deuterium, for the ordinary hydrogen, the new procedure allows the ready separation of this catalyst hydrocarbon from the hydrocarbons present owing to the gasoline synthesis reaction.

Gas from Coal in Continuous Process

➤ PURIFICATION and recovery of synthesis gas from raw coal is possible by a continuous low cost process. Dr. A. E. Sands and Dr. L. D. Schmidt described to the Houston Meeting of the American Chemical Society the pilot plant operation at the Morgantown, W.Va., branch of the Bureau of Mines. The gas is employed as one step in the production of liquid fuels from coal by the Fischer-Tropsch process.

Complete removal of sulfur is the most important problem to be faced in the purification of synthesis gas, the chemists said. Its removal is a matter of interest not only to the synthetic liquid fuel plants of the future but to present and proposed plants which will produce ammonia, alcohols, and other chemicals from coal through the medium of synthesis gas.

The recovery of sulfur in connection with the purification of synthesis gas will yield important credits to the cost of gas purification. Cost estimates indicate that the cost of sulfur removal does not increase in proportion to the concentration of sulfur in the gas. On the other hand, the net credits resulting from sulfur recovery do increase. This would mean that the use of higher sulfur coals for synthesis gas production, rather than being objectionable, would be desirable.

The recovery of sulfur from manufactured gas in any plant is not entirely a matter of economics. Several plants have found it necessary to reduce the amount of air pollution which results from those purification processes which vent hydrogen sulfide to the atmosphere. These plants have turned to sulfur recovery as a means of disposing of the hydrogen sulfide.

Former wastes from citrus fruit and juice canneries are now put through a special drying plant and then made into a meal for cattle and hogs.

Eelworms in Soil Combatted By Liquid Petroleum Chemicals

Soil Fumigation

▶ULTRASONIC waves and radioactive fertilizers are among the weapons of the future which, Dr. B. G. Chitwood of Catholic University reports, will be used to fight plant disease.

An underground gas attack that wipes out nematodes, or eelworms, by the millions, already is helping American farmers to conquer the mysterious "soil sickness" which has plagued their crops for generations. Petroleum chemicals which can be applied in liquid form and which turn into gas on entering the soil have proved remarkably effective against the multitudinous and costly nematodes. Specific nematocides, as the compounds are called, have been fashioned to suit soil conditions and temperatures in various parts of the country, so that each farmer can select the weapon best fitted to his needs.

So far, however, the selection of the best nematocide for a specific soil condition has been accomplished on a "cut and try" basis, Dr. Chitwood stated. But the unlimited numbers of organic compounds demand a more truly scientific approach and the day is not far off when chemicals may be eliminated in the laboratory by merely testing their capacity to penetrate synthetic nemic lipids (fats and waxes characterized by solubility in chloroform, insolubility in water and a greasy feel) and making a few computations of solubilities and vapor pressures. This will be merely the first step.

Later, soil nematocide will be supplanted by chemotherapy, Dr. Chitwood said. Plants will be fed materials toxic to the eelworm but harmless to man. Nutrients will be introduced into the plant to replace those stolen by the nematode. And neutralizers of nemic enzymes will be fed the plant. But, Dr. Chitwood continued, science still will not be content. Control of plant diseases may be taken over by ultrasonics and radioactive fertilizers. Already this is foreshadowed by present X-ray treatments of pork for the dread *Trichinella spiralis* infection.

An indication of what may be accomplished in the future is contained in the present. A farmer whose land has been treated with the modern nematocides, says Dr. Chitwood, often finds to his amazement that he did not know in the past what normal plants looked like.

Poor plant growth is commonly due to the microscopic nematodes which attack the roots.

Injuries may be caused by mass invasion of small roots by the nematodes with consequent mechanical destruction. The nematodes may inject enzymes into the plant upsetting its metabolism, or they may cause nutritional deficiency by sucking vital elements from plant cells.

Their microscopic size causes people to underestimate their importance. However, a single plant may be attacked by six million of these little

creatures, each capable of producing 10,000 young in 90 days. The magnitude of their numbers more than compensates for their small size.

Twenty years ago the agricultural scientist could tell the farmer to plant clean plants on clean land, but unfortunately he could not tell the farmer how to do either. However, soil fumigation has been brought within the reach of the farmer. Such materials have raised crop production and "soil sickness" is no longer a mysterious and hopeless matter.

Something has been learned of the basic principles of soil fumigation. The little eelworms are most resistant when in the egg stage, covered by a wax membrane and a protein jelly. The jelly absorbs water from the air. The wax protects the egg from injurious materials present in the soil. Extraction and crystallization have shown the membrane to be similar to refined beeswax. In order to kill the young eelworms, chemicals (nematocides) are injected into the ground, diffuse through the soil, dissolve in the soil moisture and penetrate the jelly covering the eelworm eggs as well as the vitelline membrane.

The embryonic eelworms contain oil droplets and similar fatty or waxy materials ensheath their nerves. After penetrating the waxy vitelline membrane, effective nematocides upset the colloidal system of the cells causing the oil droplets to coalesce. When this happens the eelworm dies. Extremely heavy doses of nematocides dissolve and extract oils and waxes from their bodies but such heavy doses are not essential to economic soil fumigation. By learning the nature of the protective barriers set up by the nematode, the chemist can now produce artificial membranes and study the penetration of these membranes under controlled conditions. Thus, many compounds may be eliminated in the laboratory without field study and further advances may be made in the preparation of suitable soil fumigants.

Liquids are easily applied as soil fumigants by the farmer. However, dispersal of liquids through the soil to reach the eelworms is not as thorough as gaseous diffusion. Therefore, the chemist turns to liquids which become gaseous after entry into the soil.

Since soil conditions and temperatures differ in various parts of the country, no single nematocide can be expected to fit the requirements of all farmers. Special products are now provided to meet the needs of each farm group. Today the farmer may choose between chloropicrin, methyl bromide, dichloropropene, ethylene dibromide, allyl bromide, dichlorobutene, chlorobromopropene and mixtures of these with other substances.

When streaks of rust first begin to appear on galvanized metal roofs they may be controlled with a mixture of oil with Venetian red or metallic zinc.

Pyrethrum for insecticides, grown principally in Japan in prewar days, is now being experimentally raised in Ceylon with promising results.

Housing Industry Uses Materials Undreamed of Forty Years Ago

Thine Alabaster Cities

Reprinted from the INDUSTRIAL BULLETIN of Arthur D. Little, Inc.

HOUSING is usually viewed as a social problem, but manufacturers of building materials and a few builders find it increasingly an outlet for technological ingenuity. American housing still falls far short of the ideal, but even before the wartime destruction abroad it was the best in the world. Up to 1940, the ratio of dwelling units to families was almost the same as in 1900, although the family size had declined from 4.76 to 3.77 persons. Wartime restriction of building and rapid postwar growth in number of families created a definite shortage, but the current building boom promises to restore the 1940 level of housing supply and perhaps improve on it. A recent survey shows that seven million families plan to buy or build homes between 1949 and 1953, enough to support a continued and expanded boom.

As to quality, today's house is definitely not the plastic palace of wartime dreams. The buyer gets less and less space for his money, but most critics consider the compactness, functionality of design, improved materials, and mechanical equipment of the modern house superior to anything the past has offered, and a few of the new low-cost house designs are a marked advance. Most of the criticism is directed at the dreary, blighted slum areas that were long ago fully depreciated, both on the books and in fact. The Twentieth Century Fund estimates that to bring all American housing up to a reasonable minimum of quality between 1946 and 1960 would cost $85 billion at 1940 prices and that $73 billion of this will be spent through the "normal operation of the market," assuming continued prosperity. With such expenditures, the "housing industry" becomes comparable in magnitude with the automobile industry.

Materials manufacturers have introduced to the industry such unconventional products as wall-boards of various kinds, fibrous insulation material, composition flooring, radiant heating, and many others. Output of manufactured wallboards and related products in 1946 was four times the 1929 level, equivalent to one third the number of board feet of lumber used in construction; even this substantial production figure has since been exceeded. Forty years ago most of these products were but a gleam in the manufacturer's eye.

Gypsum board, the most important of these products in terms of amount sold—3,150 million square feet in 1946—got its start in World War I. Three quarters of the production is used in homes. Made of gypsum plaster between sheets of slightly absorbent fibrous paper, the material is used as a lath base for plaster for interior walls or as a wallboard requiring no plaster. During World War II and most of the time since, wallboard has

been the more important product, since it permits economical "dry wall" construction, an increasingly popular technique. An exterior gypsum sheathing board used during the war has since declined in importance, but a new type of "weather proofing" may revive it. Both inside and outside, the use of large panels instead of individual boards saves construction labor.

Though long known, plywood has grown tenfold in use since 1925. Half the 1800 million square feet used in 1948 went into new houses for doors, wall panels, subflooring, and exterior sheathing, in both conventional and prefabricated houses. With waterproof synthetic resin adhesives to permit use outdoors, one third of the total production in 1947 was of the exterior grade.

About 2000 million square feet of structural insulation board is now used annually, 75 per cent of it in houses as interior paneling, roof insulation, and general building board. Made from wood and other fibers, it was first produced in 1914. Hard-board, of which roughly 1000 million square feet is used annually is also made from wood fibers, with the lignin of the wood as a bonding material to produce a hard, strong, and dense board, used as interior paneling and flooring, and as a base for a variety of products, such as prefinished tile.

Asbestos-cement products—shingles, corrugated sheets and boards of Portland cement reinforced with asbestos fiber—are tough, hard, fireproof, and weatherproof. The value of U. S. production was estimated at $50 million in 1946, compared with $10 million in 1929. The shingles are used mostly in houses and the sheets and boards for non-residential and farm construction. A sandwich of fiber insulating board faced with asbestos-cement board is a relatively new product for residential exterior walls, partitions, and roof decks.

Home insulation, which has grown at least tenfold since a pneumatic method of insulating existing houses was developed in 1930, has probably done as much as anything for family comfort and it cuts fuel bills markedly. The commonest insulating material is mineral wool, made from rock, slag, or glass, with sales estimated at $30 million in 1947. New and growing materials are cotton treated to prevent fire and mildew, and vermiculite, a mineral which unfolds into wormlike forms when heated. Vermiculite production rose from 22,000 tons in 1940 to 87,000 in 1946, with 60 per cent used in insulation and the rest as aggregate in plaster and lightweight concrete.

Also contributing to winter comfort is radiant heating, little more than a dream ten years ago, but now a reality in the gigantic Levittown development on Long Island and in many other development and custom-built homes. Locating the heating pipes or ducts in the floor or the ceiling to radiate heat to the room surfaces and occupants gives a uniform, comfortable temperature. In some cases a radiant-heated floor is essential to low-cost concrete-slab floor construction. New prefabricated finned coils for ceilings are expected to make installation easier and thus encourage

use. Still another potent contribution to comfort is the automatic furnace; a 1946 survey showed that 73 per cent of the houses planned would use oil or gas for heating.

A glance at new construction reveals many other innovations. Concrete block is now common, with 761 million blocks to be used in homes in 1949, and poured lightweight concrete is coming into use. Larger, lighter brick and tile are in prospect. Aluminum in roofing, siding, and doors is common on farms, and is moving into the city. Glass is more generously used and, if the architects, who are now converted to modern design, succeed in influencing the merchant builders, use of glass in the future will be enormous.

Because changes in housing are accepted slowly, introduction of new materials requires decades rather than years, but there is evidence that the pace is quickening. Although prefabrication has been generally disappointing, 30,000 such homes were shipped in 1948. The most radical in construction is the porcelain-enameled sheet steel Lustron house, in which the Reconstruction Finance Corp. has invested $37.5 million, with more now needed. About 1800 houses had been shipped up to September, 1949, and production of 15 houses a day was far from the breakeven point of 35 to 50 houses a day. Other prefabricators are now offering two-bedroom houses, complete with lot, for under $6000, and one company, National Homes Corp., is shipping 22 a day. More radical in interior plan, and perhaps ultimately more significant as a means of manufacturing houses, is the Levittown development, where 4700 houses are to be built this year, at an expected net profit of $2 million. For $8,000 the house offers two bedrooms with space for finishing two more, radiant heating, a 16-foot double-glazed window, automatic washer, storage walls, and a movable bookcase-partition. Such a large-scale operation can and does cut through the restrictions which have increased costs of building and provides an easily reached outlet for new materials and methods.

Animals Better Fed than People

➤ RECENT developments in feeds for America's farm animals have brought better diets to the barnyard than most people enjoy, the National Farm Chemurgic Council meeting in Washington was told.

Vitamin studies, particularly on vitamin B-12 in the so-called "animal protein factor," wider use of amino acids and better knowledge of mineral requirements of farm animals was described by Dr. H. J. Prebluda, nutritional chemist for New York's U.S. Industrial Chemicals Corp. He predicted that the coming decade would be called "the fortified fifties."

"If as much interest could be aroused in feeding our population as in baby chicks and hogs," said Dr. Prebluda, "we would not only be the best fed nation on earth, but we wouldn't worry over crop surpluses."

Proudly Presented

A new CHEMISTRY *feature listing announcements of industrial products.*

➤ WHITE RUBBER will be more in evidence for refrigerator gaskets as well as for bathing caps, and will find new uses made possible by Cyanamids Antioxidant 2246, according to an announcement by B. W. Henderson, manager of the Intermediate and Rubber Chemicals Department, Calco Chemical Division, American Cyanamid Co., Bound Brook, N. J.

➤ FLAME RESISTANT HYDRAULIC FLUID which satisfactorily withstood tests in an underground coal-cutting machine at 1500 lbs. per sq. in. is offered to industry by Monsanto under the designation OS-16. A clear, blue, oily liquid with a slight, sweet odor, it has a flash point at 435°F and a viscosity index of 76, and is non-toxic. Chemically it is an ester base containing no halogenated hydrocarbons, salts or water. It is a nonconductor of electricity. Special hose, gaskets, packing material and paints must be used with OS-16, but these are already on the market. Announcement of the material comes from Charles H. Sommer, assistant general manager of the company's Organic Chemicals Division, who suggests that further information may be obtained from Monsanto Chemical Co., Development Department. Organic Chemicals Division, 1700 South Second St., St. Louis 4, Mo.

➤ LACQUERS AND PAINTS whose surfaces show a pleasing flatting effect combined with film hardness and good sanding qualities are forecast by Witco as the result of researches they have been carrying on with different preparations of zinc stearate. They have had in mind also consistencies which handle well in grinding mills. They announce Witco Zinc Stearate, Lacquer Grade #1 and offer the experience of their Technical Service staff. The report on this product is available from Witco Chemical Co., 295 Madison Ave., New York 17, N. Y.

➤ GLACIAL ACRYLIC ACID which will be used to form many polymers ranging from soft rubber-like materials to hard transparent plastics is being put on the market by the B. F. Goodrich Co. They derive it from beta-propiolactone, which they introduced in 1947. They expect the 97% anhydrous material to offer economies in manufacture of acrylic esters, in polymerizations conducted in organic solvents, in formation of metallic and ammonium salts and in preservation of the double bond of acrylic acid in addition reactions. New uses for acrylic compounds are forecast by W. S. Richardson, president of the B. F. Goodrich Chemical Co., who notes that calcium acrylate is now being tested by U. S. Army engineers as a soil stabilizing agent, to clear up muddy roads and airfields. Information on the glacial acid in ton or drum lots is available from J. F. Moriarty, 324 Rose Bldg., Cleveland, O.